MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for June, 1898, is based on about 2,940 reports from stations occupied by regular and voluntary observers, classified as follows: 147 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,583 from voluntary observers; 96 received through the Southern Pacific Railway Company; 29 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological and Magnetic Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. F. H. BIGELOW, in charge of Forecast Division.

But one general wind storm occurred in the interior of the country and none on the Atlantic or Pacific coasts. Detailed remarks relative to winds and forecasts are given below. Thunderstorms were quite frequent and severe and generally forecast successfully. Slight frosts occurred at extreme northern and Rocky Mountain stations. The river forecasts of approaching low water were of special value, preliminary to the light navigation of the summer season. The areas of high and low pressure were not remarkable for great barometric departures.

The following special articles by the respective members of the Forecast Division give all that need be said with regard to a month whose meteorology was rather tamer than usual.

WIND SIGNALS.

During the month no signals were displayed on the lower Lakes, two displays for storms were made on the upper Lakes, and the information signal was displayed once on the south New England coast.

With the exception of moderate gales at Cleveland of 36 miles per hour, on the 14th and 19th, lasting from an hour to an hour and a half, and several gusts of a few minutes duration, due generally to thunderstorms, no high winds occurred on the lower Lakes.

On the 1st, information signals for brisk northeast winds were displayed on the south New England coast, and on the 4th and 5th special wind forecasts were telegraphed to stations on the middle Atlantic and south New England coast for high northeast winds diminishing in force.

Moderately high winds were reported as follows:

1st, Nantucket, 36 northeast; 3d to 4th, Nantucket, 35 northeast; 4th, Eastport, 32 northeast; 4th to 5th, Atlantic City, 38 northwest; Cape Henry, 39 northeast; Hatteras, 42 north; 25th, New York, 40 southeast.

On the 24th at 10:30 a. m., southwest storm signals were ordered for Lakes Michigan and Huron and the eastern portion of Lake Superior; a maximum wind of 50 miles an hour from the southwest occurred over the southern end of Lake Michigan and a maximum of 38 miles southwest at Marquette on the 24th.

On the 28th a southeast storm signal was displayed at Marquette, well in advance of a wind of 32 miles from the south.

The month of June presented few instances of high winds on the Atlantic and Gulf coasts, or on the Lakes. On the 1st and 2d the barometer was relatively low near Nantucket, Mass., while an area of high pressure covered the St. Lawrence Valley. Maximum velocities of 30 to 40 miles occurred on the southeast New England coast, but the winds were steady and not unfavorable to shipping. Quite a similar condition occurred on the 4th and 5th, when a high area extended from New England to the South Atlantic States, giving maximum velocities of 30 to 40 miles at exposed places on the middle and north Atlantic coasts. The barometric

gradients were very wide apart during these high coast winds, and, as there was no visible storm center, it was not easy to account satisfactorily for the observed velocities. These are instances of the general fact that high areas are capable of producing high winds along their edges, though these are usually associated, if not exclusively so in the public mind, with a low barometer and storm center. There were no other high velocities of the wind in June, except the temporary gusts which accompany the development of thunderstorms.—*F. H. Bigelow, Professor.*

THUNDERSTORM FORECASTS.

The spring season of 1898 has been comparatively slow in warming up to summer temperatures; at the same time the eastward circulation of the upper atmosphere was apparently very stagnant. When the solar radiation became at last effective in warming the lower strata, this produced conditions favoring local convectional overturning of the lower strata, and the development of showers and thunderstorms in excess of the general amount belonging to June. The forecasts for June have as a rule, in the experience of the Weather Bureau, had a lower percentage of verification than any other month, and this is due to the turbulent convectional interchange between the surface and the lower cloud strata. On the 7th thunderstorms occurred in the Mississippi Valley and on the Rocky Mountain slope; on the 8th they covered the Ohio Valley, the Lake region, and the Southern Mountain slope; on the 9th they recurred in about the same districts; on the 10th they covered the Lake region, the Ohio and the Mississippi valleys; on the 11th they repeated in the same districts and extended somewhat toward New England; on the 12th they overspread New England and the Atlantic States, and occurred again in the Lake region, the Ohio, and lower Mississippi valleys; on the 13th they were reported in about the same districts; on the 14th they occurred in the Atlantic States, and began to appear once more on the Middle Mountain slope; on the 15th they were confined to the Gulf States and the Mountain slope; on the 16th, 17th, and 18th they were generally limited to the east Gulf States; on the 19th they visited the lower Lake region and the east Gulf States. After this date thunderstorms became somewhat less frequent. Their occurrence was generally well covered by the forecasts during the period just described. One noticeable fact may be mentioned, namely, that thunderstorms do not by any means limit themselves to localities included in the eastern quadrants of the low areas, but are found all around the periphery of the high areas, and also very frequently within a high area itself. This shows that it is the vertical convection, rather than the horizontal circulation, which is chiefly concerned in the production of this class of local storms. Sometimes the cumulus cloud stratum from the west may overflow a stagnant lower layer of air, and thus intensify these thunderstorm conditions. Insolation at the ground and overflowing of cool air at the height of a mile or two primarily produce these overturnings and local storms.—*F. H. Bigelow, Professor.*

FORECASTS AT CHICAGO, ILL.

The storm of June 24–25 was the only one during the month which was attended by high winds quite generally over the upper Lakes. The following message was issued on the 24th to Lakes Michigan and Huron and eastern and central Lake Superior:

> Hoist storm southwest signals at 10:30 a. m. Partly cloudy weather and squalls indicated, with brisk to high southwest winds.

Maximum wind velocities were reported as follows: Chicago, 50; Marquette, 38; Alpena, 38; Green Bay, 30. The displayman at Mackinaw wrote, under date of June 25:

> The most severe storm seen in this section for a long time began yesterday at 12:30 p. m., two hours after hoisting signals, the wind blowing a gale from southwest to west, accompanied by very heavy thunder squalls and very heavy rain. The storm caused considerable damage to electric wires; telegraphic communication to portions of northern Michigan was interrupted for twenty-four hours.

E. B. Garriott, Professor and Forecast Official.

FORECASTS AT SAN FRANCISCO, CAL.

No warnings of weather conditions were issued during the month of June. A serious and destructive norther occurred on June 29 and 30 throughout the region from San Francisco and Stockton northward, and mention of it was made in the daily forecasts. However, since there were no means of protecting the crops then exposed against its effects, a special warning was not deemed advisable.—*W. H. Hammon, Local Forecast Official.*

FORECASTS AT PORTLAND, OREG.

No wind-signal orders were issued during the month, there being no storms.

During June the prevailing barometric conditions were most peculiar. The "summer type" of weather conditions did not appear, and the result was that frequent showers occurred, with peculiar temperature changes. Under abnormal barometric conditions accurate forecasts are more difficult to make than when normal conditions prevail. From time to time during the month the office published information that the summer conditions had not yet arrived and that showers must be expected. This information was of great value to the farmers, for it enabled them to save their hay crop. Frequent personal and telephonic requests were made by fruit men, farmers, and hay dealers for special weather forecasts in connection with hay, strawberries, and cherries. Requests were made by farmers for logotype postal-card forecasts, and the requests were granted.

Inman, Poulson & Co., a large lumber firm in this city, constructed a raft containing 5,000,000 feet of rough lumber, to be taken to San Francisco by tugs. Success meant large profits and a new industry; failure meant the loss of many thousand dollars. They consulted this office and intended to start the raft when I said so; but, owing to prices, they started before I was satisfied that they were safe. I wanted a summer weather type. Fortunately they were fairly successful, losing only about 500,000 feet. They informed me that the next raft would go in August, on "Weather Bureau orders only."—*B. S. Pague, Local Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During the month the paths of eight highs and ten lows were sufficiently well defined to be traced, and they will be found on Charts I and II in this REVIEW. The accompanying table gives the principal facts regarding the first appearance of these conditions and the date and place of their disappearance, their duration, length of path, and velocity. The more interesting facts of the month relate to the occurrence of thunderstorms, and a note on their development will be found under the proper head.

Highs.—In projecting these highs on Chart I it should be noted that often they are extremely indefinite in their appearance and hence the positions are often only approximate. Also, as has been repeatedly stated before, in northwest Canada, the appearance of both highs and lows is quite deceptive, owing to the fact that the current temperature is used in making the reduction of pressure to sea level. In consequence of this a morning low temperature will produce a fictitious high, or very much exaggerate a weak one. This difficulty is avoided in the United States by using the mean temperature of the current and previous observation, thereby

diminishing the effect of the diurnal change in temperature. Of the highs three appeared off the Pacific coast, two to the north of Montana, and three in Manitoba or the Lake Superior region. Five of these were traced to the south Atlantic coast, two to Newfoundland, and one disappeared in Illinois.

Lows.—Of the lows, five were first seen near Montana, three in the central Plateau region, and two in the lower Missouri Valley. Six of the storms could be followed to Newfoundland, two were last noticed off the middle Atlantic coast, and one died out in the central Gulf States. As low No. I moved into the Atlantic Ocean a northeast wind of 52 miles an hour occurred at Block Island, p. m. of 4th. As low No. VIII reached the upper Lake region, evening of the 25th, a west wind of 48 miles an hour was caused at Cleveland. The same afternoon Parkersburg experienced a thunderstorm with west wind of 52 miles, and Pittsburg the same kind of wind of 48 miles from the northwest.—*H. A. Hazen, Professor.*

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	*28, a. m.	37	124	1, p. m.	32	78	3,240	4.5	720	30.0
II	1, p. m.	52	96	3, p. m.	49	60	1,740	2.0	870	36.2
III	1, p. m.	37	123	11, a. m.	32	78	5,490	9.5	578	24.1
IV	5, a. m.	50	84	9, a. m.	34	76	1,500	4.0	375	15.6
V	12, p. m.	52	115	19, p. m.	48	54	3,780	7.0	546	22.5
VI	17, a. m.	50	107	20, a. m.	39	88	1,500	3.0	500	20.8
VII	20, a. m.	49	93	25, p. m.	27	79	2,370	5.5	431	18.0
VIII	23, a. m.	42	127	30, p. m.	33	75	4,200	7.5	560	23.3
Total							23,820	43.0	4,574	
Mean of 8 paths							2,977		572	23.8
Mean of 43 days									554	23.1
Low areas.										
I	*29, a. m.	54	116	3, a. m.	41	69	2,580	5.0	504	21.0
II	1, p. m.	42	112	5, p. m.	31	88	2,550	4.0	637	26.5
III	6, p. m.	54	113	10, a. m.	48	55	2,730	3.5	780	32.5
IV	8, p. m.	36	99	12, a. m.	48	78	1,470	3.5	420	17.5
V	10, a. m.	47	120	15, p. m.	47	55	3,060	5.5	556	23.2
VI	14, p. m.	51	118	21, a. m.	50	58	3,450	6.5	531	22.1
VII	21, p. m.	41	110	26, a. m.	49	56	2,640	4.5	587	24.5
VIII	24, p. m.	46	94	27, a. m.	46	55	1,830	2.5	732	30.5
IX	25, a. m.	41	104	29, p. m.	44	69	2,550	4.5	567	23.6
X	26, p. m.	53	118	†1, p. m.	48	58	2,640	5.0	528	22.0
Total							25,440	44.5	5,842	
Mean of 10 paths							2,544		584	24.3
Mean of 44.5 days									572	23.8

* May. †July.

RIVERS AND FLOODS.

During June the general tendency of all streams, except the extreme upper Mississippi and central Missouri, was to lower levels, and at intervals navigation on the rivers of South Carolina, Georgia, and Alabama, and on the Ohio and Cumberland rivers was seriously interrupted. Good navigable stages, however, were maintained on the Mississippi, Missouri, Arkansas, and Red rivers.

Heavy and in some instances excessive precipitation from the 2d to the 4th over the watersheds of the extreme upper Mississippi and the St. Croix rivers caused a rapid and decided rise of the rivers in that vicinity, and some apprehension was felt by squatters in the lowlands. There is no steamboating in that section; there is, however, considerable logging carried on, and the latter interest is reported as having sustained considerable damage. Sawmills were shut down and bottoms overflowed, the latter resulting in slight damage to crops. A moderate flood also occurred in the Kansas City river district, but no material damage was done.

The highest and lowest water, mean stage, and monthly range at 118 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

For fuller details see Monthly Bulletin of the River and Flood Service for June, 1898.—*F. W. Krichelt.*

Heights of rivers referred to zeros of gauges, June, 1898.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,957	14	10.7	8,9	4.7	30	7.3	6.0
Reeds Landing, Minn	1,887	12	9.0	11	4.2	30	6.4	4.8
La Crosse, Wis	1,822	10	9.9	15	5.0	1	7.6	4.9
North McGregor, Iowa	1,762	18	10.0	19,20	4.6	1	6.8	5.4
Dubuque, Iowa	1,702	15	9.4	21-23	4.5	1-3	6.9	4.9
Leclaire, Iowa	1,612	10	6.0	24-27	3.1	2-5	4.5	2.9
Davenport, Iowa	1,596	15	7.4	24-26	4.0	1-6	5.5	3.4
Galland, Iowa	1,475	8	4.4	27	2.2	8	3.2	2.2
Keokuk, Iowa	1,466	14	7.9	27	3.3	9	5.6	4.6
Hannibal, Mo	1,405	17	9.3	28	4.9	8	7.0	4.4
Grafton, Ill	1,307	23	13.8	18	10.3	9,10	11.6	3.5
St. Louis, Mo	1,264	30	25.4	18	18.7	26	21.3	5.7
Chester, Ill	1,189	30	20.0	18,19	14.7	26	16.8	5.3
Cairo, Ill	1,073	40	30.9	1	21.8	26	25.0	9.1
Memphis, Tenn	843	33	24.9	1	15.6	15,29	18.7	9.3
Helena, Ark	767	44	36.0	1	23.2	30	28.0	12.8
Arkansas City, Ark	635	42	42.8	1	27.1	30	33.5	15.7
Greenville, Miss	595	40	36.8	1	22.6	30	28.3	14.2
Vicksburg, Miss	474	41	42.0	1-3	27.8	30	34.2	14.2
New Orleans, La	108	16	14.9	2,3	10.2	23	12.9	4.7
Arkansas River.								
Wichita, Kans	720	10	5.6	10	2.3	7	3.9	3.3
Fort Smith, Ark	345	22	13.8	16	6.7	3	9.3	7.1
Dardanelle, Ark	250	21	14.0	18	7.5	4	10.0	6.5
Little Rock, Ark	170	23	15.3	19	9.8	6	11.6	5.5
White River.								
Newport, Ark	150	26	14.5	1	6.1	28,29	7.9	8.4
Des Moines River.								
Des Moines, Iowa	150	19	8.6	11	3.7	30	4.7	4.9
Illinois River.								
Peoria, Ill	135	14	13.5	1	8.8	26	10.8	4.7
Missouri River.								
Bismarck, N. Dak	1,201	14	12.6	26	9.0	14,15	10.5	3.6
Pierre, S. Dak	1,006	14	11.2	28	8.2	1	9.4	3.0
Sioux City, Iowa	676	19	14.7	30	12.1	19,20	13.2	2.6
Omaha, Nebr	561	18	14.0	30	11.9	20,21	12.8	2.1
St. Joseph, Mo	373	10	10.1	10,11	7.6	1	8.8	2.5
Kansas City, Mo	280	21	21.5	12	16.6	24,25	18.7	4.9
Boonville, Mo	191	20	19.3	15	14.6	25	16.6	5.7
Hermann, Mo	95	24	18.8	17	13.4	25	15.9	5.4
Ohio River.								
Pittsburg, Pa	966	22	6.9	15	2.9	17	5.3	4.0
Davis Island Dam, Pa	960	25	6.7	15	3.2	12,29	4.5	3.5
Wheeling, W. Va	875	36	9.9	20	3.4	12	5.6	6.5
Parkersburg, W. Va	785	35	9.5	21	5.2	10	7.1	4.3
Point Pleasant, W. Va	703	36	9.3	1	3.4	12	5.9	5.9
Catlettsburg, Ky	651	50	13.0	1	4.4	13	8.2	8.6
Portsmouth, Ohio	612	50	14.5	1	6.0	14	9.4	8.5
Cincinnati, Ohio	499	45	18.8	1	8.1	15,16	11.7	10.7
Louisville, Ky	367	24	8.6	1	4.6	17	6.3	4.0
Evansville, Ind	184	30	18.6	1	6.4	18	10.1	12.2
Paducah, Ky	47	40	19.8	1	8.6	14	12.2	11.2
Allegheny River.								
Warren, Pa	177	7	5.0	28	0.9	{17-20, 26,27}	1.4	4.1
Oil City, Pa	123	13	3.8	30	1.2	9-12	1.8	2.6
Parkers Landing, Pa	73	20	4.5	29	1.0	8,9,12	1.8	3.5
Freeport, Pa	26	20	6.4	20	2.1	11,29	3.4	4.3
Conemaugh River.								
Johnstown, Pa	64	7	2.2	14	1.4	7-9	1.7	0.8
Red Bank Creek.								
Brookville, Pa	35	8	2.1	14	0.1	8-12	0.9	2.0
Beaver River.								
Ellwood Junction, Pa	10	14	5.0	19	—0.3	10-12	0.7	5.3
Cumberland River.								
Burnside, Ky	434	50	3.8	19	0.7	14	2.0	3.1
Carthage, Tenn	257	30	3.4	1,22	1.5	14	2.3	1.9
Nashville, Tenn	175	40	7.5	1	2.1	15	3.5	5.4
Great Kanawha River.								
Charleston, W. Va	61	30	7.6	20	4.4	2	6.5	3.2
New River.								
Hinton, W. Va	95	14	3.4	19,20	1.3	9-14,29,30	1.8	2.1
Licking River.								
Falmouth, Ky	30	25	4.5	29	1.0	18	1.9	3.5
Miami River.								
Dayton, Ohio	69	18	2.4	14	1.2	30	1.7	1.2
Monongahela River.								
Weston, W. Va	161	18	1.5	17	— 0.6	24-26	—0.4	2.1
Fairmont, W. Va	119	25	2.2	14	— 0.3	9,10	0.5	2.5
Greensboro, Pa	81	18	8.1	21	6.5	28	7.2	1.6
Lock No. 4, Pa	40	28	7.9	15	5.9	10,11	6.6	2.0
Cheat River.								
Rowlesburg, W. Va	36	14	3.5	21	1.8	8-13	2.2	1.7
Youghiogheny River.								
Confluence, Pa	59	10	3.9	14	1.0	10,11	1.8	2.9
West Newton, Pa	15	23	2.0	15	0.4	28-30	0.8	1.6
Muskingum River.								
Zanesville, Ohio	70	20	9.8	16	6.5	24-28	7.4	3.3

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height	Date.	Height.	Date.		
Tennessee River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Knoxville, Tenn	614	29	.....	.....	.....	.....	.....	.....
Kingston, Tenn	534	25	3.3	21, 22	0.2	14–16	1.4	2.1
Chattanooga, Tenn	430	33	5.6	22	1.6	15	2.9	4.0
Bridgeport, Ala	390	24	4.6	23	0.6	12, 15, 16	1.6	4.0
Florence, Ala	220	16	3.8	25	0.5	14	1.4	3.3
Johnsonville, Tenn	94	21	4.3	2	1.4	16	2.7	2.9
Clinch River.								
Speers Ferry, Va	156	20	5.9	19	0.3	{6, 7, 9, 10/ 13, 16}	1.1	5.6
Clinton, Tenn	46	25	11.5	21	3.4	15	5.2	8.1
Wabash River.								
Mount Carmel, Ill	50	15	15.0	1	3.0	30	6.3	12.0
Red River.								
Arthur City, Tex	668	27	12.5	16	5.6	2	8.9	6.9
Fulton, Ark	565	28	18.5	18	9.0	5, 6, 13	12.3	9.5
Shreveport, La	449	29	14.1	1	9.1	15	11.5	5.0
Alexandria, La	139	33	14.1	3	8.4	18	11.3	5.7
Atchafalaya Bayou.								
Melville, La	100*	31	32.0	1–3	25.6	30	29.7	5.4
Ouachita River.								
Camden, Ark	340	39	12.0	30	5.8	30	8.0	6.2
Monroe, La	100	40	19.4	1	12.2	15	14.9	7.2
Yazoo River.								
Yazoo City, Miss	80	25	17.4	2	4.0	30	10.3	13.4
Chattahoochee River.								
Columbus, Ga	140	20	5.0	22	−0.4	1–3	0.5	5.4
Flint River.								
Albany, Ga	80	20	3.6	30	0.5	7–10	1.5	3.1
Cape Fear River.								
Fayetteville, N. C	100	38	7.0	21, 22	1.1	9, 12	2.8	5.9
Columbia River.								
Umatilla, Oreg	270	25	21.8	17, 18	19.2	30	20.7	2.6
The Dalles, Oreg	166	40	36.9	20, 21	32.2	10	34.8	4.7
Willamette River.								
Albany, Oreg	99	20	4.5	2, 3	2.0	27–30	3.0	2.5
Portland, Oreg	10	15	20.7	19, 21, 22	18.5	9, 10, 30	19.6	2.2
Edisto River.								
Edisto, S. C	75	6	3.0	25–27	0.4	13–16	1.5	2.6
James River.								
Lynchburg, Va	257	18	1.3	1, 20, 21	0.4	{10, 11, / 28–30}	0.8	0.9
Richmond, Va	119	12	0.9	6	0.0	29, 30	0.4	0.9

Heights of rivers referred to zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Alabama River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Montgomery, Ala	265	35	1.5	24	−0.8	13	0.2	2.3
Selma, Ala	212	35	1.4	27	−1.3	12, 14, 15	−0.2	2.7
Coosa River.								
Rome, Ga	225	30	3.6	20	1.2	12	1.8	2.4
Gadsden, Ala	144	18	2.1	23	−0.1	16	0.5	2.2
Tombigbee River.								
Columbus, Miss	285	33	1.7	17	−3.1	13	−1.8	4.8
Demopolis, Ala	155	35	1.8	20	−1.5	14	0.0	2.3
Black Warrior River.								
Tuscaloosa, Ala	90	38	1.3	27	−0.7	13	00.0	2.0
Pedee River.								
Cheraw, S. C	145	27	4.8	20	0.8	12–14	1.0	4.0
Black River.								
Kingstree, S. C	60	12	6.8	30	0.2	18	2.3	6.6
Lumber River.								
Fairbluff, N. C	10	6	1.0	28	−0.9	13–18	−0.1	1.9
Lynch Creek.								
Effingham, S. C	35	12	6.4	23	1.7	15, 16	3.1	4.7
Potomac River.								
Harpers Ferry, W. Va	170	16	2.9	1	1.2	29, 30	1.7	1.7
Roanoke River.								
Clarksville, Va	155	12	3.6	19	0.3	10–12	1.1	3.3
Sacramento River.								
Red Bluff, Cal	241	23	1.0	1	0.1	26–30	0.4	0.9
Sacramento, Cal	70	25	13.3	4	9.0	30	10.9	4.3
Santee River.								
St. Stephens, S. C	50	12	6.6	24	−2.0	15, 16	1.2	8.6
Congaree River.								
Columbia, S. C	37	15	2.2	20	1.0	11–13, 15	1.5	1.2
Wateree River.								
Camden, S. C	45	24	10.5	18	1.4	13, 14	3.4	9.1
Savannah River.								
Augusta, Ga	130	32	9.7	21	4.0	11, 30	5.1	5.7
Susquehanna River.								
Wilkesbarre, Pa	178	14	3.0	12	0.0	{11–13, 19–22, 27–30}	1.0	1.2
Harrisburg, Pa	70	17	4.3	1	1.7	30	2.6	2.6
Juniata River.								
Huntingdon, Pa	80	24	4.1	1	2.9	30	3.4	1.2
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	3.5	1	1.0	2, 8	2.0	2.5
Waccamaw River.								
Conway, S. C	40	7	2.8	9	0.1	16	1.4	2.7

*Distance to Gulf of Mexico.

THE WEATHER OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The statistical aspects of the weather of the month are presented in the tables which form the closing part of this REVIEW. Table I, in particular, contains numerous details that are important in the study of climatology. The numerical values in the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to VIII, inclusive.

PRESSURE AND WIND.

Normal conditions.—The geographic distribution of normal barometric readings at sea level and under local gravity for June is shown by Chart V of the MONTHLY WEATHER REVIEW for June, 1893.

Normal pressure in June is highest over the south Atlantic and north Pacific coasts and lowest over Arizona and the Plateau region. As compared with May, it is the same or slightly less in all districts, except the south Atlantic coast, where there is a slight increase, amounting to about 0.02 inch on the average.

The prevailing winds, except on the Pacific coast, are generally from a southerly quarter—southwesterly in New England and the lower Lake region, southerly in the Mississippi Valley, the south Atlantic and Gulf coasts, and southeasterly on the Plains. On the Pacific coast the general tendency is to blow from some westerly quarter.

The current month.—The distribution of monthly mean pressure, as shown by Chart IV, is closely in accord with normal conditions. Pressure was almost normal in the majority of districts, the greatest plus departures occurring in North Dakota and Manitoba and over a narrow strip of the Rocky Mountain region, extending from Denver to Helena. Pressure was below normal over Arizona, Nevada, California, Oregon, and part of Washington.

The changes from May to June were rather large, there being an increase of from 0.05 to 0.08 inch over the territory bordering the Atlantic from Connecticut southward, and extending inland to the Ohio Valley and the lower Lakes. There was a corresponding decrease over the upper Missouri Valley and the Northwest, amounting to 0.12 inch at Williston and 0.06 inch at Denver. Pressure also fell 0.05 inch and over in California from Sacramento southward.

The prevailing winds on the Atlantic coast were almost without exception from seaward or parallel with the coast line. Some distance inland they became southwesterly, shifting to westerly in the lower Lake region. On the upper Lakes the prevailing direction was in some cases from the northwest and in others from the east and southeast.

In the Mississippi Valley and the Plains region the winds were generally southeasterly; in the upper Mississippi Valley from the north and northwest. The winds over the Rocky Mountain and Plateau regions were generally from a southerly quarter, and on the Pacific coast from the northwest and west.

TEMPERATURE OF THE AIR.

Normal conditions.—The normal mean temperature of the air in the United States in June varies from about 82° at Key West, 80° at Jacksonville, 80° at New Orleans, 82° at Galveston, 64° at San Diego, to 55° at Eastport, 64° at Burlington, 65° at Buffalo, 68° at Detroit, 58° at Duluth, 61° at St. Vincent, 61° at Havre, 62° at Spokane, and 59° at Seattle, on Puget Sound. The warmest regions now are the lower Rio Grande Valley and southwestern Arizona, including a portion of the desert region of California. The seacoast is cooler than the interior on corresponding parallels. The coldest portion of tho United States is the region about Lake Superior.

In studying the distribution of monthly mean temperatures it will be found very helpful to consult the charts at the end of this REVIEW, especially No. VI, Surface Temperatures, Maximum, Minimum, and Mean. This chart gives a very good idea of the variations of temperature with latitude and longitude, and also of the distribution of normal surface temperatures. Chart VI for any month will differ from a normal chart merely in the displacement or bending of the isotherms northward or southward according as the temperature of the particular locality is above or below the normal for the place and season.

The current month.—The temperature of June, 1898, was above normal in all districts save New England, North Dakota, the southern slope, and the southern plateau. The month opened with an abnormally cool spell in the Northwest, bringing with it freezing temperatures and killing frosts over the elevated portions of Wyoming, Colorado, Idaho, and Montana. Temperatures below freezing were also registered in Minnesota and North Dakota.

The average temperatures of the respective geographic districts, the departures from the normal of the current month and from the general mean since the first of the year, are presented in the table below for convenience of reference:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	62.0	− 1.2	+ 7.1	+ 1.2
Middle Atlantic	12	71.0	+ 0.1	+ 8.6	+ 1.4
South Atlantic	10	77.7	+ 0.5	+ 6.0	+ 1.0
Florida Peninsula	7	81.1	+ 1.6	+ 2.4	+ 0.4
East Gulf	7	80.6	+ 1.5	+ 4.9	+ 0.8
West Gulf	7	79.7	+ 0.7	+10.5	+ 1.8
Ohio Valley and Tennessee	12	75.9	+ 1.9	+11.4	+ 1.9
Lower Lake	8	68.5	+ 1.4	+17.3	+ 2.9
Upper Lake	9	63.0	+ 0.5	+19.4	+ 3.2
North Dakota	7	62.6	− 2.0	+23.1	+ 3.8
Upper Mississippi	11	73.1	+ 1.9	+17.1	+ 2.8
Missouri Valley	10	72.8	+ 1.8	+19.4	+ 3.2
Northern Slope	7	62.9	+ 0.1	+ 8.1	+ 1.4
Middle Slope	6	72.8	+ 1.2	+ 9.2	+ 1.5
Southern Slope	5	75.7	− 0.6	+ 8.4	+ 1.4
Southern Plateau	13	74.3	− 0.2	− 0.7	− 0.1
Middle Plateau	9	65.6	+ 1.4	− 7.0	− 1.2
Northern Plateau	11	62.1	+ 0.6	+ 5.1	+ 0.8
North Pacific	9	58.8	+ 1.4	+ 5.3	+ 0.9
Middle Pacific	5	62.9	+ 1.1	− 4.3	− 0.7
South Pacific	4	67.9	+ 1.3	+ 0.2	0.0

The minimum temperature of the month was recorded at Breckenridge and Walden, Colo., viz, 17° on the 5th.

The maximum temperature of the month was recorded in the desert region of southeastern California. Maximum temperatures of 100° and over were observed in southern Georgia, central Alabama, and at a number of points on the Plains and eastern foothills of the Rocky Mountains. Maximum temperatures of 100° were also recorded in western Colorado, in southern Idaho, in the great valley of California, and throughout Arizona and southern Utah. The maximum temperature did not reach 90° in northern New England, western New York, and northern Minnesota.

But few prostrations from heat were reported during the month. A hot wave passed over the Lake region on the 24th and again on the 30th. The heat on the last-named date was general throughout the Mississippi Valley.

The distribution of the observed monthly mean temperature of the air is shown by red lines (isotherms) on Chart VI. This chart also shows the maximum and the minimum temperatures, the former by broken and the latter by dotted lines. As will be noticed, these lines have been drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level; the isotherms relate, therefore, to the average surface of the country in the neighborhood of the various observers, and as such must differ greatly from the sea-level isotherms of Chart IV.

In Canada.—Prof. R. F. Stupart says:

> The most striking feature in the distribution of temperature was the great difference which occurred between the average mean of the upper and lower Lakes, White River being 3° below average and Parry Sound as much as 5° above. In the Georgian Bay region, the lower Lake region, and the Ottawa Valley, also in British Columbia and northern Alberta, the temperature was above average, but elsewhere in Canada it was generally average or a little below.

PRECIPITATION.

Normal conditions.—The regions of heavy precipitation, 4 to 6 inches in June, are mainly on the Gulf and south Atlantic coasts. There are, however, other areas, in various parts of the interior, which have, according to the present normal charts, an average precipitation of 4 inches and over. Some of these areas, doubtless, appear on the charts as a result of the practice of including months of torrential rains in the general sums and averages of a short series of observations. Their present boundaries are, therefore, uncertain.

There is, undoubtedly, a greater tendency to heavy downpours in some localities than in others, but it is difficult at present to delimit the precise areas thus liable to excessive precipitation.

The region eastward of the one hundredth meridian has a variable summer rainfall. In some part of the territory there is each year total or partial drought. Happily, however, much of the region has an average rainfall in excess of the actual needs of agriculture.

The current month.—While many localities received more than the average precipitation, the month, as a whole, must be classed as one of deficient rainfall. The rainfall east of the Mississippi River was below normal, except in portions of the Ohio Valley, especially in Kentucky and West Virginia, the upper Lake region, northern New York, and northern New England. There was also less than the normal rainfall in the upper Mississippi Valley (from La Crosse northward) and in the Missouri Valley between Yankton and Williston. The drought noted in former REVIEWS as prevailing in Florida was not broken at the close of the month, although local rains had relieved the situation in some sections. The rainfall of Georgia was very light and there was a general deficiency northward to New England.

Heavy rains for the season fell in Louisiana, Texas, except on the immediate coast, Oklahoma, western Arkansas, Missouri, Iowa, and eastern Kansas. The rainfall of the northern and part of the middle slope was also in excess of the normal.

Torrential rains fell in Kansas and Missouri on a number of dates, those of the 16th being especially destructive. A dam broke at Chelsea Park, in Kansas City, Kans., as a result of the heavy downpour, allowing the waters of a small lake to escape. A flood of water swept down the valley of Jersey Creek, through Kansas City, Kans., to the Missouri River, demolishing property and wrecking culverts and bridges. It is estimated that two hundred families lost more or less of their worldly possessions and that $100,000 worth of property was destroyed. Four lives were lost by drowning

June 23.—A so-called cloud-burst struck Galesburg, Ill., on the morning of the 23d. Walnut Creek rose 44 feet in a few hours and flooded the country for miles. One person was drowned. Cambridge, Ill., 23d, S. B. Randell, voluntary observer of the Weather Bureau, reports rain began about midnight of 23d, being exceedingly heavy between 5 and 7:30 a. m. Six inches of rain fell between midnight and 7:30 a. m. The Edwards River bottom for a mile in width was a sea of water. Corn and oats were destroyed and bridges were washed away. The heavy rain was local. Galva, the nearest reporting station, measured but 3½ inches. Two lives were lost.

Two freight trains on the Northern Pacific Railway encountered a cloud-burst a short distance above Coalspur, Mont. The engineers were surprised by a perfect avalanche of water, which came rushing down the mountain side, carrying with it débris of every description.

Average precipitation and departures from the n mal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	1.47	51	−1.40	+ 2.20
Middle Atlantic	12	2.47	67	−1.20	− 2.70
South Atlantic	10	3.82	75	−1.30	− 9.80
Florida Peninsula	7	2.75	41	−4.00	−12.50
East Gulf	7	3.01	60	−2.00	−12.90
West Gulf	7	4.69	124	+0.90	− 2.10
Ohio Valley and Tennessee	12	3.83	91	−0.40	− 0.10
Lower Lake	8	2.73	75	−0.90	− 0.60
Upper Lake	9	3.71	100	0.00	− 0.10
North Dakota	7	3.50	90	−0.40	− 0.80
Upper Mississippi	11	3.84	85	−0.70	+ 3.70
Missouri Valley	10	4.60	135	+1.20	+ 3.20
Northern Slope	7	2.24	85	−0.40	+ 0.30
Middle Slope	6	2.92	94	−0.20	+ 3.30
Southern Slope	6	3.00	91	−0.30	− 1.60
Southern Plateau	13	0.76	211	+0.40	− 0.10
Middle Plateau	9	0.36	64	−0.20	− 0.90
Northern Plateau	11	0.76	60	−0.50	− 2.40
North Pacific	9	2.57	113	+0.30	− 4.80
Middle Pacific	5	0.42	81	−0.10	− 8.10
South Pacific	4	0.02	17	−0.10	− 5.10

In Canada.—Professor Stupart says:

The distribution of rainfall for June is, in several respects, rather remarkable. Over the greater portion of Assiniboia it was below average, and to the extent of 2.0 inches at Medicine Hat. In Ontario, from the southern shores of the Georgian Bay south to Lake Ontario and east to the Ottawa River, it was below average, except locally in Northumberland and Hastings, and apparently generally in the eastern townships. The rainfall was especially light in York and Simcoe, likewise in Frontenac and Leeds. In all the large remaining portion of the Dominion it was above average, especially so from eastern Manitoba to Lake Superior, and also over the greater portion of the Province of Quebec. Winnipeg was 2.9 inches above average; Port Arthur, 4.4 inches above; Montreal, 2.0 inches above; and Quebec, 2.6 inches above.

SNOWFALL.

Heavy snow fell in Wyoming on the 3d and 4th, the total at Lander being 15 inches, with smaller amounts at other stations. Light snow fell at a number of stations in the mountain region of the west on the 2d and 3d, and again at a few stations in Montana on the night of the 30th. Press reports state that half an inch of snow fell at Collingwood, Ont., on the night of the 20th; also that snow fell at Chester, Orange Co., N. Y., on the 22d.

HAILSTORMS.

The following account of severe hailstorms has been compiled from newspaper reports and statements of voluntary observers:

2d.—A destructive hailstorm passed through that portion of Nelson County, Va., comprised between upper Rockfish and the Amherst County line, late in the evening of this date. Crops of every description were destroyed.

6th.—The vicinity between Rockyford and Lajunta, Colo., was visited on the evening of the 6th by a very severe hailstorm, 5 miles in width and 12 miles long, the storm being especially severe over a width of about 2 miles. Trees were stripped of foliage; young hogs, turkeys, etc., were killed; and much fruit was destroyed.

9th.—Minonk, Ill., hail on the 9th did considerable damage to fruit, corn, and oats, and broke hundreds of window lights.

10th.—Severe hailstorms occurred at different points in Lower Michigan. Stones measuring from 4½ to 5½ inches in circumference fell at Pawpaw.

11th.—A severe hailstorm occurred at Olivet, Mich.

12th.—A severe hailstorm visited a section of country on Stillwater Creek, 10 miles south of Perry, Okla. The track of the storm was about 1 mile wide; length, unknown.

Hail fell for about thirty minutes, accompanied by high wind northwest of Wellington, Kans. The damage was confined to a small area, but the destruction of crops was complete.

13th.—A severe rain and hail storm visited the southern part of King William County, Va., on the evening of the 13th. The length of the storm track, so far as known, was not more than a mile.

19th.—Hailstones from ⅞ to 1¼ inch in diameter fell at Rolla, Mo., from 9:12 to 9:26 a. m.

A severe hailstorm passed through Belt, Mont., on the evening of the 19th. The stones were reported to have been as large as hens eggs, many of them weighing an ounce and a half.

24th.—A very destructive hailstorm having its origin in Benson County, N. Dak., moved eastward in a path from 1 to 8 miles in width, passing through the counties of Ramsey and Walsh, N. Dak., and Marshall, Minn. Crops in the pathway of the storm were very much damaged. According to newspaper reports, the area of grain destroyed was about 50,000 acres, and the loss from $150,000 to $200,000. A few buildings were wrecked by the wind, and many head of stock were killed by lightning. Two persons were killed by lightning 12 miles west of Minnewaukon.

28th.—A severe hailstorm of limited area passed over portions of Somerset and Mercer counties, N. J.

30th.—Standing crops and vegetables and gardens were totally destroyed by a severe hailstorm that passed through the center of Lyon and Sioux counties, Iowa, at 8 o'clock of the above date. The path of the storm was about 2 miles wide. The storm moved from the northwest. Severe damage from hail was also reported from O'Brien County, just east of Sioux.

The following are the dates on which hail fell in the respective States:

Alabama, 2, 18. Arizona, 22. Colorado, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 26, 27, 30. Connecticut, 14, 22. Florida, 5, 13, 16, 17. Georgia, 1, 5, 14, 15, 17, 20, 30. Idaho, 2, 3, 6, 11, 12, 13, 14, 20, 28, 29. Illinois, 1, 6, 7, 9, 14, 18, 25. Indiana, 12. Iowa, 9, 10, 13, 14, 17, 22, 24, 25, 29, 30. Kansas, 1, 11, 18, 25. Kentucky, 6, 9, 11, 19. Louisiana, 22. Maryland, 2, 3, 13. Massachusetts, 22. Michigan, 1, 2, 10, 11, 12, 25. Minnesota, 2, 3, 17, 23, 24, 28, 29. Mississippi, 13. Missouri, 1, 8, 9, 14, 18, 24, 25, 26. Montana, 1, 3, 4, 5, 6, 10, 11, 13, 14, 19, 22, 25, 26. Nebraska, 3, 13, 17, 24, 28. Nevada, 1, 2, 11. New Hampshire, 22. New Jersey, 22. New Mexico, 6, 7, 9, 10, 11, 13, 14, 22, 23. New York, 11, 19, 22, 25. North Carolina, 2, 18, 21, 27. North Dakota, 2, 7, 16, 18, 23. Ohio, 10, 11, 12, 14, 25. Oklahoma, 11, 12, 15. Oregon, 10, 15, 19. Pennsylvania, 2, 11, 19, 22, 27. South Dakota, 2, 3, 4, 5, 11, 17, 24, 28, 30. Tennessee, 9, 12, 19, 26. Texas, 1, 4, 5, 8, 9, 15, 16, 18. Utah, 2, 6. Vermont, 22. Virginia, 12, 13, 26, 28. Washington, 1, 13, 20, 27. West Virginia, 12. Wisconsin, 2, 3, 24, 25. Wyoming, 4, 5, 6, 11, 12, 14, 15.

Hail was reported on the greatest number of dates in Colo-

rado, 17; Montana, 13; Idaho and Iowa, 10 each; New Mexico and South Dakota, 9 each.

SLEET.

The following are the dates on which sleet fell in the respective States:

California, 1. Montana, 2. Wyoming, 4.

HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in 1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In general the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

The current month.—Several wide departures from the normal may be noticed. The Florida Peninsula was very much drier than usual, the mean for that region being 74 per cent, or about the same as obtains for the Middle States under normal conditions. The mean for the west Gulf States was 81 per cent, the same it will be noticed as for New England. The mean for Palestine, Tex., was 88 per cent, an unusually high record for an inland station. The lowest monthly mean was 17 per cent, viz, at Independence, Cal., followed by a mean of 25 per cent at Phenix, Ariz. Independence is situated in Owens River Valley, east of the Sierra Nevada Mountains. The average rainfall is about 6 inches per annum.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	81	+ 1	Missouri Valley	72	+ 3
Middle Atlantic	71	− 2	Northern Slope	58	+ 2
South Atlantic	76	− 2	Middle Slope	65	+ 6
Florida Peninsula	74	− 7	Southern Slope	68	+ 8
East Gulf	75	0	Southern Plateau	32	+ 4
West Gulf	81	+ 7	Middle Plateau	42	+ 5
Ohio Valley and Tennessee	67	− 3	Northern Plateau	53	+ 1
Lower Lake	71	− 1	North Pacific Coast	74	− 5
Upper Lake	76	+ 3	Middle Pacific Coast	64	− 1
North Dakota	69	+ 1	South Pacific Coast	63	− 1
Upper Mississippi Valley	73	+ 2			

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of the prevailing pressure on the psychrometer has the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values of the relative humidity for the day; probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic and at 47 by its thermal effects. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table IX for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun for an hour after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table IX for the stations at which instrumental self-registers are maintained.

The percentage of clear sky (sunshine) for all of the stations included in Table I, obtained as described in the preceding paragraph, is graphically shown on Chart VII. The regions of cloudy and overcast skies are shown by heavy shading; an absence of shading indicates, of course, the prevalence of clear, sunshiny weather.

The formation of fog and cloud is primarily due to differences of temperature in a relatively thin layer of air next to the earth's surface. The relative position of land and water surfaces often greatly increases the tendency to form areas of cloud and fog. This principle is perhaps better exemplified in the Lake region than elsewhere, although it is of quite general application. The percentage of sunshine on the lee shores of the Lakes is always much less than on the windward shores. Next to the permanent influences that tend to form fog and cloud may be classed the frequency of the passage of cyclonic areas.

The current month.—The month was one of rather more than the usual amount of sunshine, the Atlantic coast, the Florida Peninsula, and the Ohio Valley and Tennessee being especially free from clouds. There were fewer clouds than usual on the Pacific coast, except in the vicinity of Eureka.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.9	+0.8	Missouri Valley	4.9	+0.1
Middle Atlantic	4.7	−0.3	Northern Slope	4.4	−0.4
South Atlantic	4.1	−0.8	Middle Slope	4.0	+0.3
Florida Peninsula	3.1	−2.4	Southern Slope	3.8	−0.6
East Gulf	5.0	+0.2	Southern Plateau	2.2	+0.3
West Gulf	5.7	+1.1	Middle Plateau	3.2	+0.2
Ohio Valley and Tennessee	4.1	−0.9	Northern Plateau	4.5	−0.6
Lower Lake	4.8	−0.1	North Pacific Coast	5.4	−0.7
Upper Lake	5.5	+0.3	Middle Pacific Coast	3.6	+0.4
North Dakota	5.2	0.0	South Pacific Coast	2.6	−0.6
Upper Mississippi Valley	4.9	−0.1			

There was much cloud and rain in the west Gulf States and lower Mississippi Valley.

WIND.

The table at the end of this section shows the cases where wind velocities of 50 miles per hour and over occurred during the month of June. It will be observed that high velocities were recorded chiefly at inland stations with the exception of Block Island and Fort Canby, the two latter being in exposed situations on the sea coast.

There were two periods of high winds and thunderstorms during the month, and more or less destruction of property, attended in some cases by loss of life. The first period began on the 11th and ended on the 13th. On the 11th the only States in which thunderstorms were not reported were Maine, Massachusetts, New Hampshire, North and South Carolina, Rhode Island, and Washington. The second period of thunderstorm activity began on the 23d and continued until the 28th. During this time a storm of considerable intensity moved across the northern part of the country. The barometric gradient was rather steep over the Lake region and the upper Mississippi and Ohio valleys on the 24th and 25th, and there was considerable destruction of property by squall winds. There were not, however, so many thunderstorms as during the first period, viz, from the 11th to the 13th.

No severe tornado was reported during the month.

The usual list of local storms follows:

1st.—The director of the Texas section of the Climate and Crop Service reports a tornado as having occurred in the vicinity of Corsicana about 5 a. m. of June 1. The path was about 300 yards wide, length unknown. The storm did not strike the city, but many oil well derricks, trees, and fences were blown down. The amount of damage can not be ascertained.

2d.—A violent thunderstorm struck the city of Brainerd, Minn., at 5:10 p. m., central time. Outbuildings were wrecked, shade trees uprooted, and much damage was done to roofs and glass fronts. No casualties; amount of damage unknown.

3d.—A violent windstorm passed over the town of Aberdeen, S. Dak., between 1 and 2 a. m. No loss of life; damage confined to awnings, roofs of buildings, and plate-glass windows.

12th.—A few barns and outhouses were destroyed, trees were uprooted and twisted off, by a minor tornado in Ecorse Township in Wayne County, Mich., on the afternoon of the 12th. Telephone and telegraph wires were torn down on several lines.

13th.—High winds prevailed over a considerable portion of Alabama on the evening of the 13th. Minor damages, such as the destruction of fences and outbuildings and, in a few cases, of buildings, were reported from the northern-central part of the State.

15th.—A tornado was reported as having swept over Concordia Parish, La., late in the evening of this date. No serious damage beyond the destruction of a few houses and more or less timber.

19th.—A very severe thunderstorm, with some of the characteristics of a tornado, passed over Niagara and Orleans counties, N. Y., on the early morning of the 19th. A funnel-shaped cloud appears to have been absent. Roofs of buildings, awnings, trees, fences, and shrubbery were seriously damaged in several localities. The path of the storm was probably a half mile wide. The greatest damage in any one place appears to have been at Lockport, N. Y. After leaving this point damages of a minor character only were reported until the storm reached the vicinity of Knowlesville and Gaines, in Orleans County. Prof. Grove K. Gilbert, of the United States Geological Survey, writes from Middleport, under date of July 13, as follows:

> I happened to be in Lockport during the passage of a notable storm early on the morning of June 19, and have since crossed its track at a number of points.
>
> I was awake when it began and heard its roar at a little distance before it reached me. It began suddenly, attaining full violence in a minute or two. The force of wind lessened more gradually, but there was an abrupt cessation. I did not note duration, but think it was between ten and twenty minutes strong wind. Heavy rainfall. Hail during the first third; nearly continuous lightning, but of moderate intensity. The direction of the wind was from south-southwest or south by west during period of greatest violence. Afterwards it had some other direction, which I could not observe from my window (facing west).
>
> There was damage from wind and hail, and this was limited to a path about three-fourths of a mile wide. Much grain was "lodged," still more was cut down by hail, and green fruit was bruised. * * *

25th.—High winds and severe squalls prevailed over the Lake region, the Ohio Valley, and western Pennsylvania on the 25th. Maximum velocities of over 50 miles per hour for five minutes were recorded at Sioux City, Chicago, Cleveland, and Parkersburg. At the first-named place a maximum velocity of 66 miles per hour was recorded. Three persons were killed and many were injured at Sioux City on the evening of the 24th, as a result of stormwinds blowing down a circus tent. Three men were drowned in the Ohio River at Marietta on the 25th as a result of the stormwinds. Property losses varying from $500 to $10,000, due to the severity of squall winds, were reported at numerous places from Iowa eastward to western Pennsylvania.

Hot winds of California.—Hot, dry, northwest winds began blowing over portions of California on the night of June 30. Considerable damage was done to fruit, much of which was blown from the trees; grain was shelled out or broken down with considerable loss.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum mind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	26	50	n.	Memphis, Tenn	12	52	w.
Block Island, R. I.	4	50	ne.	Parkersburg, W. Va.	25	52	nw.
Fort Canby, Wash.	15	56	se.	Pierre, S. Dak.	2	55	nw.
Chicago, Ill	24	50	sw.	Port Huron, Mich.	12	52	w.
Cleveland, Ohio	12	60	nw.	San Antonio, Tex.	11	66	nw.
Havre, Mont.	28	52	sw.	Sioux City, Iowa	24	66	nw.
Independence, Cal	1	50	w.	Williston, N. Dak.	28	50	w.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Five thousand four hundred and fifty-five reports of thunderstorms were received during the current month, as against 5,509 during the corresponding month of 1897.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 12th, 367; 13th, 366; 11th, 357; 25th, 280; 26th, 253.

Reports were most numerous from Missouri, 367; Ohio, 336; Illinois, 258; Mississippi, 224; Pennsylvania, 222.

Thunderstorms occurred in Missouri on every day of the

month, except the 28th and 29th. In Louisiana there were one or more thunderstorms on each day of the month. In Arkansas, thunderstorms were reported on every day except the 24th. In Colorado there were thunderstorms continuously from the 3d to the 23d, inclusive. On the Pacific coast reports of 99 thunderstorms were received, distributed as follows: 33 in Washington, 39 in Oregon, and 27 in California.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from May 30 to June 7.

The greatest number of reports were received for the following dates: 22d, 6; 14th, 25th, and 29th, 4 each.

Reports were most numerous from Ohio, 6; Minnesota, North Dakota, and Wisconsin, 4 each.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 80.4°, or 2.8° above normal, the highest was 103°, at Decatur on the 10th, and the lowest, 55°, at Madison on the 1st. The average precipitation was 3.60, or 0.87 below normal; the greatest monthly amount, 7.99, occurred at Evergreen, and the least, 0.90, at Riverton.—*F. P. Chaffee.*

Arizona.—The mean temperature was 79.6°; the highest was 119°, at Parker on the 26th and the lowest, 20°, at Snowflake on the 11th. The average precipitation was 0.60; the greatest monthly amount, 2.60, occurred at Fort Apache and Oro, while none fell at Agricultural Experiment Station at Phenix, and only trace at several stations.—*W. T. Blythe.*

Arkansas.—The mean temperature was 78.7°, or 2.3° above normal, the highest was 100°, at Lonoke on the 25th, and the lowest, 60°, at several stations on different dates. The average precipitation was 4.86, or 0.80 above normal; the greatest monthly amount, 11.15, occurred at Ozark, and the least, 1.85, at Stuttgart.—*E. B. Richards.*

California.—The mean temperature was 71.3°, or 0.1° below normal; the highest was 123°, at Volcano Springs on the 26th, and the lowest, 17°, at Bodie on the 4th. The average precipitation was 0.25, or 0.01 below normal; the greatest monthly amount, 3.32, occurred at Upper Mattole. No rain fell over the greater portion of the State.—*W. H. Hammon.*

Colorado.—The mean temperature was 62.6°, or about normal; the highest was 108°, at Crook on the 28th, and the lowest, 17°, at Walden on the 4th, and at Breckenridge on the 5th. The average precipitation was 1.73, or 0.50 above normal; the greatest monthly amount, 3.95, occurred at Cheyenne Wells, and the least, trace, at Rangely.—*F. H. Brandenburg.*

Florida.—The mean temperature was 80.9°, or 1.9° above normal; the highest was 101°, at Eustis on the 12th, and at Lake City on the 16th, and the lowest, 54°, at St. Francis on the 8th and 9th. The average precipitation was 3.08, or 3.92 below normal, it was the driest June on record; the greatest monthly amount, 9.07, occurred at Earnestville, and the least, trace, at Carrabelle.—*A. J. Mitchell.*

Georgia.—The mean temperature was 80.1°, or 2.2° above normal; the highest was 103°, at Brag on the 30th, and the lowest, 50°, at Ramsey on the 23d. The average precipitation was 3.27, or 1.43 below normal; the greatest monthly amount, 6.94, occurred at Fleming, and the least, 0.89, at Atlanta and Toccoa.—*J. B. Marbury.*

Idaho.—The mean temperature was 60.8°; the highest was 102°, at Nampa on the 18th, and the lowest, 23°, at Marysville on the 2d. The average precipitation was 1.07; the greatest monthly amount, 2.10, occurred at Yellowjacket, and the least, 0.15, at Marysville.—*D. P. McCallum.*

Illinois.—The mean temperature was 73.3°, or about 1.0° above normal; the highest was 97°, at Bloomington on the 4th and 6th, and the lowest, 41°, at Kishwaukee on the 22d. The average precipitation was 4.34, or 0.35 above normal; the greatest monthly amount, 9.88, occurred at Cambridge, and the least, 1.10, at Olney.—*C. E. Linney.*

Indiana.—The mean temperature was 73.2°, or 1.1° above normal; the highest was 99°, at Winamac on the 4th, and the lowest, 39°, at Auburn on the 1st. The average precipitation was 3.81, or 0.23 below normal; the greatest monthly amount, 7.80, occurred at Princeton, and the least, 1.18, at Topeka.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 71.4°, or about 1.0° above normal; the highest was 99°, at Belle Plaine on the 30th, and the lowest, 42°, at Forest City on the 27th. The average precipitation was 4.72, or slightly above normal; the greatest monthly amount, 12.48, occurred at Greenfield, and the least, 1.90, at Olin.—*G. M. Chappel.*

Kansas.—The mean temperature was 74.9°, or 0.9° above normal; the highest was 108°, at Dresden on the 25th, and the lowest, 40°, at Colby on the 1st. The average precipitation was 4.60, or 0.54 above normal; the greatest monthly amount, 9.96, occurred at Fort Scott, and the least, 1.43, at Wallace.—*T. B. Jennings.*

Kentucky.—The mean temperature was 76.2°, or 1.4° above normal; the highest was 101°, at Shelbyville on the 10th, and the lowest, 45°, at Maysville on the 22d. The average precipitation was 3.90, or about normal; the greatest monthly amount, 7.94, occurred at Lexington, and the least, 1.55, at Williamsburg.—*G. E. Hunt.*

Louisiana.—The mean temperature was 80.1°, or about 1.0° above normal; the highest was 100°, at Plaquemine on the 1st, and the lowest 60°, at Napoleonville on the 3d, 5th, and 11th, and at Opelousas on the 5th. The average precipitation was 7.64, or about 1.75 above normal; the greatest monthly amount, 14.56, occurred at Plain Dealing, and the least, 1.07, at Port Eads.—*R. E. Kerkam.*

Maryland and Delaware.—The mean temperature was 71.7°, or 0.6° above normal; the highest was 100°, at Bachmans Valley, Md., on the 25th, and at Westernport, Md., on the 30th, and the lowest, 35°, at Deerpark, Md., on the 24th. The average precipitation was 2.00, or 1.17 below normal; the greatest monthly amount, 3.99, occurred at Newark, Del., and the least, 0.35, at Maryland Agricultural College.—*F. J. Walz.*

Michigan.—The mean temperature was 65.7°, or 0.4° above normal; the highest was 96°, at Allegan on the 5th, at Ionia on the 24th, and at Rogers on the 25th; the lowest was 27°, at Iron River on the 15th. The average precipitation was 3.61, or 0.41 above normal; the greatest monthly amount, 7.29, occurred at West Harrisonville, and the least, 0.80, at Hart.—*C. F. Schneider.*

Minnesota.—The mean temperature was 67.0°, or about normal; the highest was 99°, at Beardsley on the 23d, and the lowest, 33°, at Mount Iron on the 15th. The average precipitation was 3.93, or about normal; the greatest monthly amount, 11.79, occurred at Pine River Dam, and the least, 1.94, at St. Olaf.—*T. S. Outram.*

Mississippi.—The mean temperature was 80.2°, or 1.1° above normal; the highest was 102°, at Aberdeen on the 25th and at Columbus on the 3d, and the lowest, 60°, at Corinth on the 1st, at Leakesville on the 2d, and at Waynesboro on the 16th. The average precipitation was 4.99, or 0.74 above normal; the greatest monthly amount, 10.75, occurred at Fayette, and the least, 1.19, at Booneville.—*R. J. Hyatt.*

Missouri.—The mean temperature was 75.3°, or 1.9° above normal; the highest was 100°, at Jefferson City on the 30th, and the lowest, 42°, at Potosi on the 20th. The average precipitation was 5.89, or 1.15 above normal; the greatest monthly amount, 11.08, occurred at Arthur, and the least, 2.42, at Downing.—*A. E. Hackett.*

Montana.—The mean temperature was 58.9°, or slightly below normal; the highest was 103°, at Glendive on the 19th, and the lowest, 28°, at Adel on the 1st. The average precipitation was 3.34, or about 0.50 above normal; the greatest monthly amount, 6.79, occurred at Wibaux, and the least, 1.08, at Columbia Falls.—*J. Warren Smith.*

Nebraska.—The mean temperature was 70.4°, or about 1.0° above normal; the highest was 109°, at Franklin on the 24th, and the lowest, 33°, at Camp Clarke on the 5th. The average precipitation was 3.54, or about 0.40 below normal; the greatest monthly amount, 11.62, occurred at Geneva, and the least, trace, at Lodgepole.—*G. A. Loveland.*

Nevada.—The mean temperature was 65.0°, or 0.7° below normal; the highest was 104°, at Panaca on the 27th, and the lowest, 20°, at Monitor Mill on the 2d. The average precipitation was 0.19, or about half the normal amount; the greatest monthly amount, 2.38, occurred at Toano, while none fell at many stations.—*R. F. Young.*

New England.—The mean temperature was 64.5°, or 0.7° below normal; the highest was 93°, at Middletown, Conn., on the 25th and 26th, and at Waterbury, Conn., on the 26th, and the lowest, 31°, at Flagstaff, Me., on the 11th. The average precipitation was 2.69, or 0.20 below normal; the greatest monthly amount, 7.36, occurred at Pittsfield, Mass., and the least, 0.10, at Narragansett Pier, R. I.—*J. W. Smith.*

New Jersey.—The mean temperature was 70.1°, or 0.5° above normal; the highest was 100°, at Vineland on the 28th, and the lowest, 38°, at Charlotteburg on the 16th and 23d. The average precipitation was

2.10, or 1.55 below normal; the greatest monthly amount, 3.54, occurred at Billingsport Lighthouse, and the least, 1.13, at the College Farm, New Brunswick.—*E. W. McGann.*

New Mexico.—The mean temperature was 69.2°, or about 4.0° below normal; the highest was 106°, at Albert on the 25th, and the lowest, 23°, at Buckmans on the 3d. The average precipitation was 2.12, or 0.25 below normal; the greatest monthly amount, 6.05, occurred at Roswell, and least, trace, at Deming.—*R. M. Hardinge.*

New York.—The mean temperature was 66.9°, or 1.3° above normal; the highest was 96°, at Poughkeepsie on the 15th, and the lowest, 32°, at Alfred, Bolivar, and South Canisteo on the 16th. The average precipitation was 2.74, or 0.76 below normal; the greatest monthly amount, 6.87, occurred at Humphrey, and the least, 0.62, at Setauket.—*R. G. Allen.*

North Carolina.—The mean temperature was 74.8°, or about 0.5° above normal; the highest was 104°, at Goldsboro on the 10th, and the lowest, 40°, at Linville on the 23d. The average precipitation was 3.41, or about 1.00 below normal; the greatest monthly amount, 7.32, occurred at Sloan, and the least, 0.70, at Springhope. — *C. F. von Herrmann.*

North Dakota.—The mean temperature was 62.5°, or 2.1° below normal; the highest was 105°, at Medora on the 18th, and the lowest, 26°, at Woodbridge on the 14th. The average precipitation was 2.69, or 1.15 below normal; the greatest monthly amount, 6.80, occurred at University, and the least, 0.68, at Ashley.—*B. H. Bronson.*

Ohio.—The mean temperature was 71.9°, or 1.5° above normal; the highest was 99°, at Seaman on the 7th, and the lowest, 39°, at Montpelier on the 3d, at Rittman on the 22d, and at Greenhill on the 23d. The average precipitation was 2.86, or 0.90 below normal; the greatest monthly amount, 7.05, occurred at Millport, and the least, 0.83, at New Bremen.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 77.4°; the highest was 102°, at Jefferson and Newkirk on the 25th, and at Kemp on the 22d, and the lowest, 52°, at Waukomis on the 2d. The average precipitation was 4.64; the greatest monthly amount, 8.58, occurred at Pawhuska, and the least, 1.66, at Guthrie.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 62.2°, or 1.7° above normal; the highest was 99°, at Pendleton on the 10th, and at Riverside on the 18th, and the lowest, 23°, at Prineville on the 27th. The average precipitation was 1.72, or 0.16 above normal; the greatest monthly amount, 9.75, occurred at Toledo, and the least, 0.24, at Lakeview.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 69.6°, or slightly above normal; the highest was 100°, at Aqueduct on the 25th, and the lowest, 33°, at Shinglehouse on the 16th. The average precipitation was 2.79, or 1.31 below normal; the greatest monthly amount, 6.96, occurred at Elwood Junction, and the least, 0.56, at Reading.—*T. F. Townsend.*

South Carolina.—The mean temperature was 79.7°, or 2.2° above normal; the highest was 105°, at Gillisonville on the 29th, and the lowest, 55°, at Trenton on the 6th, and at Santuck on the 7th. The average precipitation was 4.15, or 0.47 below normal; the greatest monthly amount, 10.68, occurred at Pinopolis, and the least, 1.58, at Central.—*J. W. Bauer.*

South Dakota.—The mean temperature was 67.3°, or about normal; the highest was 113°, at Cherry Creek on the 22d, and the lowest, 30°, at Rochford on the 27th. The average precipitation was 2.16, or 1.62 below normal; the greatest monthly amount, 5.68, occurred at Canton, and the least, trace, at Interior.—*S. W. Glenn.*

Tennessee.—The mean temperature was 76.7°, or slightly above normal; the highest was 102°, at Elizabethton on the 10th, and the lowest, 44°, at Silverlake on the 23d. The average precipitation was 3.70, or considerably below normal; the greatest monthly amount, 7.02, occurred at Peryear, and the least, 1.41, at Andersonville.—*H. C. Bate.*

Texas.—The mean temperature for the State during the month, determined by comparison of 39 stations distributed throughout the State, was normal. There was a slight deficiency over the coast district, over the panhandle, and west Texas, with the greatest, 4.5°, in the vicinity of El Paso, while over the other portions of the State, the temperature was generally above the normal, with the greatest excess, 5.2°, in the vicinity of Brownwood. The highest was 104°, at Fort McIntosh on the 2d, 3d, and 4th, and the lowest, 40°, at Valentine on the 7th. The average precipitation for the State during the month, determined by comparison of 39 stations distributed throughout the State, was 1.78 above the normal. There was a slight deficiency along the coast, over west Texas, and in a few other localities, with the greatest deficit, 2.93, at Galveston, while over other portions of the State there was a general excess, ranging from 0.97 to 3.81 over east and north Texas and the panhandle, and from 1.02 to 5.99 over central and southwest Texas, with the greatest, 5.99, at Coleman; the greatest monthly amount, 10.85, occurred at Ballinger, and the least, 0.08, at Point Isabel.—*I. M. Cline.*

Utah.—The mean temperature was 65.2°; the highest was 110°, at Mount Pleasant on the 18th, and the lowest, 22°, at Soldier Summit on the 3d. The average precipitation was 0.78, or slightly above normal; the greatest monthly amount, 1.58, occurred at Tooele, and the least, 0.11, at Frisco.—*J. H. Smith.*

Virginia.—The mean temperature was 73.2°, or nearly normal; the highest was 104°, at Doswell on the 30th, and the lowest, 40°, at Burkes Garden on the 22d. The average precipitation was 2.85, or 0.83 below normal; the greatest monthly amount, 4.86, occurred at Bigstone Gap, and the least, 0.45, at Alexandria.—*E. A. Evans.*

Washington.—The mean temperature was 60.6°, or about 1.5° above normal; the highest was 103°, at Kennewick on the 10th, and the lowest, 28°, at Hunters on the 28th. The average precipitation was 2.38, or about 0.50 above normal; the greatest monthly amount, 8.56, occurred at Clearwater, and the least, 0.29, at Moxee.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 70.9°; the highest was 99°, at Martinsburg on the 26th, and the lowest, 41°, at Dayton and Nuttallburg on the 22d. The average precipitation was 3.20, or about 1.00 below normal; the greatest monthly amount, 7.50, occurred at Marlinton, and the least, 0.66, at Burlington.—*C. M. Strong.*

Wisconsin.—The mean temperature was 66.7°, or about normal; the highest was 96°, at Heafford Junction on the 4th, and the lowest, 31°, at Florence on the 15th. The average precipitation was 3.88, or slightly below normal; the greatest monthly amount, 9.70, occurred at Beloit, and the least, 1.50, at Eau Claire.—*W. M. Wilson.*

Wyoming.—The mean temperature was 60.0°, or 0.2° below normal; the highest was 99°, at Fort Laramie on the 28th, and the lowest, 28°, at Four Bear on the 29th. The average precipitation was 1.68, or about normal; the greatest monthly amount, 3.02, occurred at Lander, and the least, 0.55, at Bigpiney.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

A NEW METHOD OF OBSERVING THE DIRECTION OF MOVEMENT OF THE ATMOSPHERE.

By Mr. H. W. CLOUGH.

Under date of October 13, 1897, Mr. H. W. Clough, observer, Weather Bureau, who was then at Nashville, sent the Editor a communication from which the following interesting extract is made:

For a number of years I have been cognizant of a fact which may have an important meteorological bearing, and seems to throw light upon that mooted point in astronomy, the scintillation of the stars.

Several years ago I discovered that on holding a simple convex lens of, for example, 30 inches focus and 3 inches diameter, between the eye and a distant point of light, as an electric light at night, the lens being held at a distance of slightly less than the focal length from the eye, so that the light entirely fills the lens, there are seen horizontal undulations or streams, or rather, irregular masses of light and darkness moving swiftly across the field of view. These wave like masses vary in speed and definiteness of appearance with the position and distance of the source of light, and it was soon discovered that the direction of the undulations corresponded with the direction of the surface wind, and that it was easy to ascertain the latter within a few degrees by this means, as on pointing the lens in the direction of the wind no lateral movement of the undulations is observed, but simply a turbulent motion with no particular direction. This phenomenon is probably due to air currents of varying temperature passing between the light and lens, causing variations in the light coming to the eye. I have noticed a similar phenomenon during hot windy days in summer when the "boiling" at the horizon is most pronounced. By directing a telescope at various objects in different azimuths the direction of movement of the undulations or waves of the unequally heated strata of air is seen to coincide with the direction of the wind.

As to the scintillation of stars, I have no doubt that it is in all respects similar to the undulations observed with the lens in distant points of light. In fact the electric lights in a city exhibit scintillations, the more distant ones showing them with great distinctness. These are magnified by the lens and shown to be due to air currents of different temperature causing irregular refractions of the light. The more distant the light, the slower is the apparent movement of the undulations. I have many times observed with the lens bright stars near the horizon and endeavored to ascertain the direction of movement of the undulations which are plainly visible, but the lens used was not of sufficient size to allow the direction to be made out. Probably a lens of at least 5 inches in diameter and 3 feet focus would collect enough light and present a sufficiently large surface to show the direction of the undulations. It would seem that this may have an important application in meteorology as indicating a possible method of ascertaining the direction of air currents at night; not only those near the surface, but possibly those of considerable altitude.

The preceding letter would have been published at the time had not the Editor desired to obtain a few specific observations by Mr. Clough for publication in this connection. Since that time the author has been assigned to duty in Washington, and is still pursuing the study of this interesting subject which has also attracted the attention of Messrs. Douglass and See of the Flagstaff Observatory, Ariz., whose publications in the American Meteorological Journal and various astronomical journals are well known. The whole subject of scintillation has been treated quite thoroughly in a memoir by Prof. Exner, of Vienna, and the relation between scintillation and the condition of the atmosphere was for a long time studied by Montigny of Brussels; but we believe this is the first effort to apply what is known as the "schleier method" to the determination of the general direction of movement of the atmosphere.

The "schleier method," so called by its inventor, Professor Toeppler, was first applied to the photographic study of the movements of the air around moving objects. In the hands of Professor Mach and his son, at Vienna, this has become a powerful instrument of research, applicable to many problems in meteorology and a very full exposition of the method has long since been in the hands of the Editor, awaiting a favorable opportunity for presentation to American meteorologists and physicists. Meanwhile, we trust that Mr. Clough will succeed in making his simple method practically useful to meteorology.

KITES WITHIN A THUNDER CLOUD.

By Mr. THOMAS HOVENDEN.

Mr. Thomas Hovenden, who has established a kite apparatus of his own manufacture at Plymouth Meeting, Montgomery Co., Pa. (15 miles northwest of the Weather Bureau station at Philadelphia), sends the following account of a recent experience at his station:

On June 25 used a diamond cell No. 11 as pilot kite. Wind at the surface 18 to 20 miles per hour, from the southwest at first but shifting to southeast later. Diamond cell No. 10 was attached when 4,000 feet of line were out, but before the next observation (in about twenty minutes) the pilot kite entered the base of a thunder cloud that was forming and was torn from the wire, the stray line breaking. This storm did not reach the earth at the station for about forty-five minutes. All the wire and kite No. 10 were recovered. Kites Nos. 10 and 11 were exact counterparts, each having 30 square feet and being 4¼ feet high, of the diamond cell pattern. The pilot kite when entering the thunder cloud at its base shifted toward east of southeast, while the lower kite was pulling in an almost opposite direction. Electric shocks were slight except after the kite reached 4,500 feet when they were strong, forming a continuous arc about 3 inches long, with sparks, now and then, about an inch long. The height of the pilot kite when it entered the thunder cloud was about 4,200 feet, and the wire was still being paid out fast enough to scorch the brake ropes of the reel. When the pilot kite was torn away the thermometer also sailed off into the next county. I have lately made and flown a 14-foot kite, having 216 square feet of surface. I append the record of the flight of June 25 which ends with the reading at 3:50, or about twenty minutes before the pilot kite was torn away; of course the temperature record of the kite was lost.

Kite observations, June 25, at Plymouth Meeting, Pa.

Time.	Length of line.		Angular elevation of kite.	Azimuth of kite.	Pull.	Inclination of wire at reel.	Corrected elevation of kite.	Surface conditions.		Wind direction.
	Dial.	Feet.						Wet bulb.	Dry bulb.	
h. m.			°	°	*Lbs.*	°	*Feet.*	° *F.*	° *F.*	
2 45	240	1,320	43	20 e. of n.....	28	35	890	79	84	sw.
2 55	363	2,000	42	25 e. of n.....	24	25	1,307	77	81	sw.
3 15	636	3,500	42	35 e. of n.....	32	15	2,286	78	89	sw.
3 25	636	3,500	35	35 e. of n.....	20	20	1,963	77	83	sw.
3 50	727	4,000	31	50 e. of n.....	20	15	2,029	79	90	se.

The fact that the lower kite and the wire at the reel veered steadily more and more to the right as the lower kite ascended is here beautifully shown. The further and extremely great veering of the upper or pilot kite, by which it was deflected to the east of southeast at about 4 p. m., while the lower kite pulled toward the northwest, shows that the lower southeast wind was at this time and in this portion of the thunderstorm overlaid by an upper northwest wind.

METEOROLOGICAL EXTREMES AT NORTHFIELD, MASS.

By Mr. A. D. ELMER, Jr.

[Mr. A. D. Elmer, of Northfield, Mass., communicates the following collection of interesting meteorological events at that place, which may serve as a slight extension of the very interesting work, by Sidney Perley, entitled "Historic Storms of New England," published at Salem in 1891. In some cases Mr. Elmer has omitted the full reference to the proper authority from which the record is copied, but, in general, the items have all been verified.—ED.]

1815. September 23, great September gale; the only authentic West Indian hurricane in New England; passed between Providence and New London and, via Worcester and Connecticut River Valley, to the St. Lawrence River west of Montreal. From "Our First Century. By R. M. Devens. C. A. Nichols & Co., Springfield, Mass.; A. H. Walker, Columbus, Ohio. 1877." Pierce "On the Weather" notes a northeast gale at Philadelphia, September 22.

1816. A cold summer; ice every month of the year and heavy snow in June. These items, from old records, refer to the memorable year 1816, when there was no summer either in this country or in England and nearly every green thing was destroyed. For fuller details see Pierce "On the Weather" and Perley "Historic Storms."

1821. Great whirlwind on June 30. This quotation from an old book reminds one of the tornadoes in New Hampshire and Massachusetts, September 9, 1821. For fuller accounts see Perley's Historic Storms.

1866. June 7, a cloudburst. Quoted from Temple and Sheldon's History of Northfield.

1869. October. Worst floods on record, particularly in the Connecticut River. Quoted from a local diary kept by A. D. Elmer, sr., and refers especially to Northfield, as equally heavy floods have occurred in the lower Connecticut.

1881. October 14, at Central Vermont Railroad station, maximum temperature 92°.

1885. March 18, minimum temperature —20°.

1887. August 18, windrush from the southwest, or a western tornado. (This and all subsequent notes are from manuscript meteorological records kept by Mr. Elmer at Northfield.)

1888. February 14, maximum 49°; February 16, minimum —29°; February 17, maximum 39°. There was, therefore, a fall of 78° in forty hours, followed by a rise of 68° in thirty-two hours.

1888. March 11–14, deepest snowfall viz, 2 feet 6 inches.

1896. April 16, maximum temperature 96.5°; September 23, 9 p. m., temperature 31°; September 24, 2 a. m., minimum temperature 27°; summer temperature in the vicinity of or warmer than 90° on sixty-four days; during a hot spell in August 100° was recorded twice; 100° recorded three times during season; weather driest on record April to August, inclusive, except for the extra rainfall of July; first drought, eight weeks; general deficiency of the five months, one-third (excess of July one-half); first drought unbroken five weeks; December 25, —15°; December 28, —16°.

1897. January 28, snowfall 18 inches; estimated velocity maximum wind gusts, 60 miles; April 19, 1 p. m., strong south gale, clear, temperature 71°; 8 p. m., strong northwest gale, clear, temperature 29°; April 20, 5 a. m., strong north wind, clear, temperature 16°; fall, 42° in seven hours, 56° in sixteen hours; summer temperature July 1 (only two

days before this year with maximums 90° or warmer); July 2, 7 a. m., 90°; July 6, 139° in sun on sand, 106° in shade at 1 p. m.; previous maximum in twenty-one years, 100°; July 9, max. 101°, 9 p. m., 90°; July 10, 9 a. m., 94°, sea breeze then drove mercury below 90°; July 12, 10 a. m., 94°, rainstorm begins; extremes of temperature to 5 p. m., 78° and 86°, with rain falling. July 14, 9:30 a. m., minimum in the course of the storm, 70°. The unbroken hot wave in which temperatures equaled or exceeded 90° ended July 12, having lasted twelve consecutive days, being the severest on record. The thermometer recorded 90° or more from July 1 to July 25, inclusive, with two separate exceptions, being unequaled in twenty-one years of observation. July 13, 10 p. m., wind south; wind sprang up and became a very heavy gale at 4 a. m. of the 14th; at 9:30 a. m. of the 14th the rainfall for forty-seven hours had amounted to 8.38 inches, being the maximum in twenty-one years; the additional fall during the next twelve hours, including a thundershower, brought the total up to 9.27 inches in fifty-nine hours; the rainfall from July 12 to July 31, inclusive, amounted to 15.73 inches; the total rainfall, estimated, for the month is 21 inches (estimated within one-half inch), being unequaled in twenty-one years; October 16, at Central Vermont Railroad station, maximum temperature 92°, being the highest on record there in October.

1898. Severe cold spell before and after the storm of January 31 and February 1; February 3, minimum temperature —28.5°; February 3, at the toll bridge, lowest and coldest place place in town, minimum temperature —35°; January 31 and February 1, total snowfall with gale, 2 feet; February 1, depth of snow on ground, 3½ feet, being the greatest on record; May 31, rain has been recorded for thirty-six days out of the past forty-eight. Frequent showers continued until June 29, inclusive, completing a record of fifty-five rainy days in seventy-seven. The total rainfall was not very excessive.

Mr. Elmer considers that the location of Northfield is so central relative to New England that its extremes must be typical of the whole surrounding region, and as a curious commentary on the New England climate, he states that within the thirty days, June 23 to July 23, and within a radius of 50 miles, they have experienced the following vicissitudes of weather: "A garden-killing frost; a two-inch snowstorm; hail; 101° in the shade; heavy thunderstorms; imitation cloudbursts; tornado from westerly points; northeast gale and rainstorm; three weeks drought; great rise and great fall of temperatures, etc."

RAINFALL AT FIRMEZA, NEAR SANTIAGO, CUBA.

Communicated by JOSIAH MONROE, Esq.

Through the kindness of the Secretary of State the Weather Bureau has received a copy of the following letter and table which constitutes an important contribution to our knowledge of the meteorology of the eastern portion of Cuba. Owing to the mountainous character of the country, it is evident that very many more stations will be necessary in order to give us anything like a true idea of the normal climate of that province.

The Secretary and Treasurer of the Juragua Iron Company, Limited, Mr. Josiah Monroe, at Philadelphia, writes to the Secretary of State under date of April 15, 1898, as follows:

In this connection I beg to present herewith a statement taken from the actual weather records kept since July, 1888, at Firmeza, our mining village in the mountains, near the city of Santiago de Cuba, showing the rainfall in each month and the total for each year.

It is probably needless to mention what is of general knowledge, that the rainy season begins in the latter part of April and extends with varying severity through October. The months of by far the heaviest rainfall are May, September, and October, and these months by reason of this very great humidity are comparatively unhealthy.

These remarks are intended to bring out the fact that although at the present moment the climate in the Island is dry and healthful, we are just on the border land of the rainy season, when all outdoor operations are liable to be considerably impeded by the weather.

The following data is copied from the records of the Juragua Iron Company, Limited. Firmeza is the mining town of the company, and is located about 16 miles east of the city of Santiago de Cuba and about 5 miles inland; it is among the mountains and about 500 feet above sea level.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1888 ...	.....	.....	.....	.....	.....	.....	1.61	7.80	19.45	5.19	4.70	1.75	.....
1889 ...	0.04	0.60	10.22	8.86	11.90	2.90	1.35	8.40	21.78	9.38	1.01	0.31	76.75
1890 ...	2.22	0.56	8.58	2.19	6.62	4.25	3.80	4.01	10.78	1.89	9.60	1.34	55.84
1891 ...	2.48	1.10	0.81	9.10	6.43	8.85	2.30	7.15	5.15	13.94	2.61	0.22	60.14
1892 ...	3.18	1.42	0.39	1.40	7.91	1.15	4.43	10.10	4.16	13.98	1.74	1.65	51.51
1893 ...	0.91	1.07	0.86	3.56	9.92	2.38	5.16	11.57	7.23	9.94	5.43	2.50	60.53
1894 ...	0.54	0.15	2.26	2.37	11.79	8.90	2.25	5.04	7.49	12.92	0.60	1.93	56.24
1895 ...	0.13	0.90	0.38	1.71	8.15	5.78	5.92	4.45	8.50	19.20	8.14	0.36	63.42
1896 ...	2.90	4.35	1.62	0.39	7.54	0.48	2.20	9.65	17.07	6.35	0.97	4.70	58.22
1897 ...	0.05	0.00	0.77	4.80	11.05	6.80	8.60	2.75	10.10	38.65	5.70	1.30	90.57
1898 ...	0.40	1.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean 1889-97	1.38	1.13	2.88	3.82	9.03	4.61	4.00	7.01	10.23	14.03	3.98	1.59	63.69

The Editor has added the monthly means for the nine complete years, 1889–1897, but the careful reader will perceive that these are far from representing normal values, owing to the great range of monthly rainfall shown by the figures in each column.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for June, 1898.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Aguascallentes	6,106	23.86	88.5	57.4	72.9	56	4.80	ne., se.	ese.
Durango (Seminario)	6,243	24.39	90.5	50.0	72.3	37	1.95	sw.	e
Leon (Guanajuato)..	5,934	24.26	89.8	53.6	71.8	48	5.95	ese.	ne.
Linares (New Leon)..	1,188	28.67	96.1	64.4	79.2	66	2.72	se.	s.
Magdalena (Sonora).	2,618	.....	95.9	70.0	80.6	.....	5.08	sw.	n.
Mexico (Obs. Cent.)..	7,472	23.04	80.2	51.4	63.0	62	3.95	n.	ne.
Morelia (Seminario)..	6,401	23.94	86.2	55.6	67.6	68	3.60	sw.	ne., e.
Oaxaca	5,164	25.03	91.8	52.9	71.6	70	7.33	s.	e.
Puebla (Col. Cat.)*...	8,752	23.33	81.3	44.6	66.9	70	4.32	e.	s.
San Isidro (Hac.).....	.....	.....	82.4	66.2	.....	.....	4.21	.....	.....
Tampico (Tam.).....	38	29.88	91.9	69.4	81.3	79	16.85	se.	se.
Tuxpan (Vera Cruz)..	.....	30.14	98.6	71.6	80.1	79	9.08	e.	e.
Zacatecas	8,015	22.48	85.8	48.6	64.0	54	1.12	e.	e.

*This new altitude responds to a change of 500 meters, and may be a clerical error in the original manuscript.—ED.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, a copy of the daily record at Honolulu is communicated to the Weather Bureau in advance of its official publication, and is herewith printed, as a special contribution, for the convenience of those who are studying the relations of the storms and weather of the United States to those of adjacent countries, with a view to long-range, seasonal predictions.

Meteorological observations at Honolulu.

JUNE, 1898.

June, 1898.	Pressure at sea level. 7 a. m.	3 p. m.	9 p. m.	Temperature. 7 a. m.	2 p. m.	9 p. m.	Maximum.	Minimum.	Relative humidity. 7 a. m.	2 p. m.	9 p. m.	Wind. Direction.	Force.	Cloudiness.	Rain measured at 6 a. m.
1.	30.04	30.00	30.08	72	80	74	81	72	70	56	74	ne.	4	4-2	0.00
2.	30.06	30.01	30.05	71	79	73	82	69	74	60	74	ne.	3	3	0.03
3.	30.04	29.99	30.04	71	80	72	82	71	78	57	82	nne.	3	4	0.00
4.	30.06	30.01	30.07	70	79	73	80	69	70	58	72	n.	3-1	4-1	0.18
5.	30.03	30.00	30.05	71	76	71	78	69	67	60	77	ne.	3	5	0.01
6.	30.02	29.99	30.04	70	78	72	80	66	73	65	77	ne-e.	3	4	0.31
7.	30.04	30.00	30.05	70	80	71	81	67	77	66	90	ene.	3-1	2 8	0.06
8.	30.04	30.01	30.08	70	79	71	80	68	....	70	84	s-ne.	1	3-10	0.32
9.	30.07	30.02	30.09	68	81	74	82	65	82	61	74	s-ne.	1	0-5	0.20
10.	30.09	30.04	30.09	72	81	75	81	70	79	60	72	ne.	3	3	0.00
11.	30.09	30.04	30.09	74	77	75	79	73	67	59	70	ene.	4	8-10	0.00
12.	30.06	30.02	30.08	74	80	74	81	73	70	59	70	ne.	3	5-1	0.00
13.	30.06	30.04	30.11	73	81	75	82	72	70	59	74	ne.	2-4	3	0.00
14.	30.14	30.11	30.17	72	80	74	81	71	....	54	70	ne.	3	2	0.03
15.	30.16	30.11	30.15	71	79	74	81	70	82	62	78	ne.	3-1	6-3	0.08
16.	30.14	30.09	30.13	72	80	74	82	70	70	57	71	nne.	3-1	5-2-6	0.02
17.	30.10	30.02	30.06	72	77	73	82	69	70	70	86	ne.	3-1	1	0.00
18.	30.05	30.01	30.08	69	82	75	84	65	82	55	70	ne.	2	2	0.02
19.	30.10	30.07	30.12	71	82	75	84	68	82	58	74	nne.	2	1	0.00
20.	30.11	30.04	30.09	74	82	75	84	73	72	55	74	nne.	2	1	0.00
21.	30.09	30.01	30.04	70	82	76	84	69	67	55	74	ne.	2	1	0.00
22.	30.04	30.07	30.10	71	75	73	82	71	80	91	95	se-ne.	0-1	7-10	0.02
23.	30.14	30.11	30.16	68	81	76	83	68	91	65	72	ne.	3	3-1	1.26
24.	30.13	30.10	30.12	74	80	74	81	73	70	59	82	w-e-nne.	3	8-5	0.00
25.	30.06	30.00	30.05	74	80	76	81	71	74	64	72	ene.	3-5	3	0.06
26.	30.04	30.02	30.05	74	80	76	82	71	82	68	70	ene.	4-5	5	0.10
27.	30.05	30.03	30.09	74	77	76	81	74	74	67	64	ene-nne.	4	5-8	0.06
28.	30.05	30.01	30.09	73	78	75	81	72	67	62	67	nne.	3	5-8	0.03
29.	30.04	29.99	30.04	72	80	75	81	69	78	54	70	nne.	2-4	5-2	0.10
30.	30.02	29.97	30.05	68	80	74	82	67	87	63	78	ne.	3	2	0.01
	30.07	30.03	30.08	71.5	79.5	74.0	81.5	69.9	....	62	75	.....	2.5	4.2	2.90

The station is at 21° 18′ N., 157° 50′ W.; altitude 50 feet.

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, —0.06, is still to be applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10. Two directions of wind, or values of wind force, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

Monthly mean temperature (7 + 2 + 9) ÷ 3 is 75.0, and the normal mean is 76.5. The normal rainfall for June is 1.56. The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 8 feet above ground. Ground is 50 feet above sea level.

OBSERVATIONS AT PORT AU PRINCE, HAITI.

Through the kind cooperation of Prof. T. Scherer of Port au Prince, Haiti, the meteorological observations taken by him at 7 a. m., local time, or 11:49 a. m., Greenwich time, are communicated in manuscript for early publication in the MONTHLY WEATHER REVIEW. By entering these on the monthly and annual charts, published by the Weather Bureau, we obtain an important extension southeastward of our field of study. The observations are taken 1h 11m earlier than those of the Weather Bureau telegraph system. The original reports are in metric measures; the conversions are by the Editor.

The barometer is 119 feet above sea level; its readings have been corrected by Professor Scherer for temperature and elevation, but not for gravity, this latter correction is —0.064 inch; the thermometers are 6.7 feet above ground; the rain gauge, 7.2 feet above ground. The wind velocity is given in miles per hour.

The position of Port au Prince, Haiti, is latitude 18° 34′ N., longitude 72° 21′ W., or 4h 49m west of Greenwich. Additional records for this station are published in the annual volumes of the Central Meteorological Institute at Vienna.

Observations at Port au Prince, Haiti.

JUNE, 1898.

Date.	Barometer reduced.	Temperature. Air.	Dew-point.	Rel. humidity.	Wind. Direction.	Velocity.	Clouds. Kind.	Amount.	Direction.	Preceding 24 hours. Total rain.	Temperature. Max.	Min.
	Inches	°	°	%						*Inch.*	°	°
1.....	29.95	76.3	70.0	82	e.	4	ck	7	w.	1.06	89.6	70.5
2.....	29.95	75.6	70.3	85	ese.	7	ck, ks	8	w.	.....	89.4	70.5
3	29.99	77.7	75.0	92	e.	9	k, ck	3	ssw.	T.	91.2	73.4
4.....	30.01	77.9	71.2	81	e.	9	.....	0	.....	1.70	92.3	70.7
5.....	29.98	75.9	71.8	88	.....	0	ck	3	sw.	0.14	90.7	70.0
6	29.97	76.3	68.2	76	e.	9	pc.	10	.....	0.00	88.5	74.3
7.....	29.98	78.3	69.8	77	e.	11	ck; cs	7	sw; wnw.	0.00	90.5	76.3
8.....	30.00	78.3	71.8	81	ese.	16	cs	4	n.	0.00	91.2	76.3
9.....	30.03	79.9	70.0	73	ese.	7	cs	8	w	0.00	91.4	75.4
10.....	30.06	78.4	66.6	68	se.	4	cs	1	.....	0.00	92.3	73.4
11.....	30.04	78.8	74.5	87	se.	9	cs	4	wsw.	0.00	91.6	76.5
12.....	30.08	77.9	66.0	69	ene.	7	k	9	se.	0.00	93.0	75.2
13.....	30.09	78.4	68.5	73	e.	4	c	1	.....	0.00	93.9	72.0
14.....	30.08	75.7	72.9	91	ne.	2	cs	9	.....	0.00	89.6	72.0
15.....	30.07	79.5	68.2	70	ese.	7	ck, cs	1	w, sw.	0.00	93.4	72.1
16.....	30.04	79.5	66.6	66	e.	4	cs	1	wnw.	0.00	93.0	73.6
17.....	30.03	77.0	67.6	74	e.	2	k	1	.....	0.00	94.6	73.2
18.....	30.04	80.6	65.8	63	e.	7	.....	0	.....	0.61	94.5	73.8
19	30.05	79.7	68.7	70	ese.	9	....	0	.....	T.	95.9	72.5
20.....	30.04	79.2	68.2	70	e.	7	s	1	.....	0.00	85.6	74.8
21.....	30.04	78.1	66.7	70	se.	2	pc	10	.....	0.00	86.0	74.8
22.....	30.06	78.1	67.8	72	e.	9	ck	1	se.	0.00	95.5	73.6
23.....	30.06	80.4	70.0	72	e.	4	cs	1	s.	0.00	94.8	73.8
24.....	30.06	79.7	67.3	68	ese.	9	cs, k	2	.. ..	0.00	95.2	73.4
25.....	30.03	77.0	67.6	74	ese.	4	cs	2	.....	0.00	93.2	72.5
26.....	30.04	80.4	67.6	67	ese.	13	.....	0	.....	T.	92.7	72.7
27.....	30.09	77.0	64.9	68	se.	4	cs	1	.....	T.	93.2	73.8
28.....	30.06	78.8	67.5	66	ene.	4	cs, k	4	.....	0.28	93.7	72.3
29.....	30.03	73.9	0.2	88	.. ...	0	cs	1	w.	1.38	93.0	70.2
30.. ...	30.04	74.3	70.9	90	e.	4	.....	0	.....	0.52	91.4	70.0
Sum...	.....	.....	.....	.....	.....	.....	.....	...	.....	5.69	.....	.....
Means.	30.03	77.9	69.1	75.7	.....	7	....	....	.....	. ...	92.1	73.0

p = pallio.

NOTES BY THE EDITOR.

SEASONAL FORECASTS IN OREGON.

For several years past the attention of our readers has been called to the spring and autumn predictions for the coming summer and winter, respectively, as published by Mr. B. S. Pague, Local Forecast Official at Portland, Oreg. We quote the following from the morning weather map of July 7, 1898, as published by the Weather Bureau at Portland, Oreg.:

The first summer type of weather conditions appears this morning. The appearance of this type marks the commencement of the summer or dry season over the Pacific Northwest. From now until the appearance of the winter type, little or no rain will fall. There will be two, three, or four days of clear, warm weather; then winds changing to the southwest, barometer rising, high fog, and cool weather for twenty-four or thirty-six hours; during the change sprinkles of rain will occur along the Oregon and Washington coast, and sometimes over western Washington and northwestern Oregon; then a day of clear weather and delightfully mild temperatures, then from two to four days of high temperatures again. The cycle is again repeated. Such are the weather conditions prevailing under the summer type. Occasionally thunderstorms occur; these follow heated periods.

Under the summer type, hot north to east winds are probable east of the Cascades; such winds never prevail except under this one distinct type. The appearance of the summer type of weather conditions is later than usual; the dates of the appearance of the summer and winter types for the past few years are:

SUMMER.		WINTER.	
1895	April 20	1895	November 12
1896	June 13	1896	October 20
1897	April 11	1897	October 19
1898	July 7		

Fair weather has prevailed over the Pacific Northwest during the past twenty-four hours. No precipitation has occurred.

The temperature has remained nearly stationary; it ranges from 48° at Fort Canby and Spokane to 56° at Idaho Falls and Wallawalla.

The weather is clear this morning, with northerly winds.

METEOROLOGICAL OBSERVATIONS IN THE KLONDIKE.

In the July number of the Scottish Geographical Magazine, Mr. William Ogilvie, astronomer and land surveyor to the Dominion of Canada, gives some account of the geog-

raphy of the headquarters of the Yukon River and the approaches to the Klondike region. According to this account gold was known to exist in the Yukon country as early as 1847, and Mr. Harper in 1872 reported gold on the Yukon everywhere, but coarse gold was not discovered until 1886, on the Forty Mile River; in 1896 gold was found in abundance in the Klondike district. At the close of his text Mr. Ogilvie gives the following summary compiled from his records of temperature, but we infer that the observations were made at many places in the course of his travels as a surveyor, and therefore do not represent any specific station. Had we the original record, then the individual observations could be entered upon the daily weather maps and would give us more exact information as to the northern limit of the cold waves that flow from the northwest provinces southeastward into and over the United States.

Year and month.	Mean of maxima.	Mean of minima.	Highest maximum.	Lowest minimum.
	°F.	°F.	°F.	°F.
1887, August	.....	39.9	.....	21.6
September	.....	31.7	.....	16.0
October	.....	18.5	.....	4.0
November	.....	— 5.1	.....	—24.1
December	—27.6	—33.6	10.5	—55.1
1888, January	—15.3	—25.3	13.0	—53.5
February	— 4.3	—16.8	24.2	—52.7
March	.....	—11.5	.....	—52.7
April	.....	—20.4	.....	—37.7
May	43.3	19.8	55.0	— 1.8
1895, August	.....	40.1	.....	28.0
September	.....	30.9	.....	21.5
October	.....	19.4	.....	—12.7
November	11.9	4.2	38.5	—36.3
December	—13.8	—18.2	6.0	—55.4
1896, January	—33.0	—41.9	6.0	—67.9
February	—11.6	—25.5	32.0	—64.8
March	18.1	— 2.4	39.5	—37.3
April	24.0	2.0	49.0	—28.4
May	48.7	28.8	62.0	5.0
June	65.1	39.8	80.0	27.8
July	68.9	44.5	81.0	33.0
August	62.6	42.1	76.0	27.2
September	50.5	34.3	63.0	4.8
October	32.9	20.2	51.0	— 1.0
November	— 6.0	—14.7	22.5	—38.0
December	— 6.5	—17.4	11.0	—44.5
1897, January	—14.0	—24.0	10.0	—55.6
February	0.6	—12.3	31.0	—36.0
March	.....	—14.7	.....	—54.3
April	.....	18.1	.....	5.0

WEATHER BUREAU SERVICE IN ALASKA.

THE MONTHLY WEATHER REVIEW for April gave some account of the proposed establishment of an Alaskan section of the Climate and Crop Service, under the direction of Mr. Hector L. Ball. The following interesting letter has been received from him:

SITKA, ALASKA, *June* 15, 1898.

Prof. WILLIS L. MOORE,
Chief of Weather Bureau,
Washington, D. C.

SIR: I have the honor to inform you that a location has been secured for at least six months, and that the instruments have been placed in position. Observations of temperature and rainfall were begun at 8 a. m. this date. The office room has not yet been papered and cleaned, hence the barometer has not been hung, but this will be done in about three days. The location is an ideal one, being on the top of a hill about 125 feet above mean tide, and about one-fourth of a mile from the bay. This will apparently give temperature and rainfall values that will be unaffected by the ocean and free from mountain currents. The office building is very small, the Weather Bureau office being 8 by 15 feet. However, we were very fortunate to secure so good a location, as some officials are yet without office quarters. No definite arrangements have been made for quarters after the end of the present lease, but it is hoped that the present quarters can be re-leased.

The office roof would not permit of a platform, it being too small and insecure. Accordingly, I have had erected a platform 20 by 20 and 6 feet from the ground. This holds the anemometer and wind vane and the sunshine recorder. The instrument shelter I have erected over sod. As soon as a suitable day arrives photographs will be taken of the building and instruments, and a copy will be sent you. The elevation will also be taken and recorded. As stated in a former letter one barometer was broken in transitu, so I have no means of determining the error, if any, of the one in use.

I have everywhere been cordially received by the people of this Territory. The establishment of a Weather Bureau and Experiment Station meets the wishes of every one, and will doubtless be of great value to those living here and to people of other countries.

Thus far the weather has been very delightful; the first half of June having been unusually warm, dry, and sunshiny. Vegetation is marvellously rich and abundant, and were it not for sudden changes, cool nights, and the prevailing cloudiness this would make a fine agricultural and residential country.

(Signed) H. L. BALL,
Section Director.

NOTES FROM THE JUNE REPORTS OF THE CLIMATE AND CROP SECTIONS.

ARIZONA.

Sand or dust storms were recorded at seven stations; that on the 18th was unusually severe, extending over Cochise, Graham, Pima, and the southern part of Navajo counties. Among the special reports are the following: Fort Grant, Graham County, altitude 4,916 feet, from 3:55 to 4:40 p. m., severe hurricane storm from north-northeast, carrying a large amount of dust from the Gila Valley, breaking large limbs from almost every cottonwood tree; Oro Blanco, Pima County, altitude 4,200 feet, most severe sand storm ever seen here occurred about sundown on the 18th. (The hours here given are likely to be local Pacific standard, not seventy-fifth meridian time.)

CALIFORNIA.

For the first time in many months the printed report of the California section is received in time to be included in this collection of notices. The number for June contains a special contribution by Dr. C. M. Richter on the climatology of the citrus belt in California, with special reference to the absence of frosts from November to April. He says:

There is no doubt that the western slope of the Sierra Nevada foothill region and also that part of southern California, inland, of which Riverside is a fair representative, offer very favorable climatic conditions for the growth of citrus fruit. They are subject, however, although rarely, to minimum temperatures, which have affected and which may affect citrus fruit disastrously. The winter of 1854 was probably more severe than the winter of 1888, or of 1898, when minimum temperatures below 20° occurred in some portions of these citrus regions. It appears that the region of the Santa Barbara foothills and probably of the entire foothill region of the Coast Range southeast of Santa Barbara, wherever the foothills do not recede too far from the ocean, is never affected in such winters to a degree sufficient to injure the growth of citrus fruit. Regular observations of temperature have been taken at Santa Barbara since 1870. The archives of the mission do not mention any injury done to any vegetation by cold temperature before 1870. Since 1870 the two lowest temperatures observed at Santa Barbara were 28.5°, on one January morning, 1888, and the next lowest, 30.5°, on another morning of the same month and year. The comparison of the climate of Santa Barbara city and Pine Crest exhibits strikingly the greater warmth of the foothill region and attests the immunity of the Santa Barbara foothills from killing frosts.

Minute studies of this character into the details of the distribution of climatic peculiarities will repay the labor in every State of the Union, since there is thus made known some positive knowledge in place of the ignorance that would otherwise prevail—knowledge that will inevitably lead to the cultivation of special crops in regions that would otherwise be neglected.

This same June report has also a special article by Mr. W. H. Hammon on the drought of 1897–98 in California. He shows that there was practically no difference in the rainfall and its distribution in the dry seasons from November to May, 1850–51, 1863–64, 1876–77, and 1897–98; therefore, the last drought is not unprecedented. Taking the State as a whole, the rainfall during the past season has slightly exceeded half the amount of a normal year. The greatest deficiencies were in southern California and the interior valleys, where the normal precipitation is light. The deficiency in the Sierras and along the northern coast, where the normal rainfall is heavy, was from 20 to 40 per cent.

Mr. Hammon is, fortunately, able to show that this severe drought is not altogether an unmixed evil, since many have learned to make themselves, in a measure at least, independent of one season's rainfall. It is a peculiar fact that almost throughout the entire State a supply of water can be found a few feet below the surface. Prof. Milton Whitney has shown the remarkable control over the water supply exerted by certain soils in certain spots in California—a power that has not yet been explained, but undoubtedly depends principally upon the physical structure of the soil. But without waiting to solve these soil problems, Mr. Hammon says:

> In seasons like the present, where a dry stratum of earth remains between the layer of soil moistened by the rainfall and that beneath which is permanently moist, this capillary action is impossible. Owing to improved pumping machinery the experiment has been successfully tried in various parts of pumping sufficient water from the substratum to thoroughly saturate the soil, thus rendering those sections independent of the current seasonal rainfall, and permitting them to raise a crop, the profit on which will be many times that of ordinary seasons, owing to the generally small yield. By this means the vast fruit regions of Santa Clara and adjacent counties will mature full crops of almost every variety of fruit. Large areas of grain have thus been irrigated by pumping or siphoning water from the rivers and sloughs. Rich tule basins in the valleys, which are under water in normal years, have this year produced heavy grain crops.

This last line reminds the Editor of a point brought out by him in a paper on the relation between climates and crops, to the effect that the statistics of crop production for any year give the average result for crops raised on all kinds of soil, dry uplands and wet lowlands, as well as in all kinds of weather. In dry years the lowlands do best, but in wet years the uplands; late spring frosts kill the plants that were planted too early, but early autumn frosts injure the plants that were started too late. The efforts of the farmer are directed toward such methods of agriculture as will better the crops on the lowlands in wet seasons and on the uplands in dry seasons. Mr. Hammon concludes this excellent paper by an article on seasonal predictions in California, which departs somewhat from the remarks previously made in the MONTHLY WEATHER REVIEW, as to the slow passage of droughts and other atmospheric influences from the Indian Ocean and Australia, first northwestward into southern Asia, and then eastward over the Pacific and America until they die away in Europe.

Every continent and ocean introduces its own series of disturbances into the circulation of the earth's atmosphere, which latter thus becomes a much more complex matter than in the ideal case of a uniform smooth globe treated of by Ferrel and other founders of dynamic meteorology. The greatest of all these disturbances are those introduced by the great chain of mountains that begins at Patagonia, runs northward through Alaska, and again reappearing in Siberia, runs southwest to the Asiatic plateau. The influence of the summer's heat on the Eastern Continent diverts the trade winds of the southern Indian Ocean from their ideal course, and a vast amount of moisture is brought by the southwest monsoon to India, Siam, and China, whence it is whirled eastward by the same upper currents that caused the spread of the Krakatoa dust vapor, during nearly three years, over the whole Northern Hemisphere. The spread of this vapor is a valuable index to the existence of the great upper currents and the interaction of the northern and southern atmospheres upon each other.

We shall take pleasure in reprinting portions of Mr. Hammon's article, omitting any reference to the Kuro Siwo or the Japanese Gulf Stream, as that could not possibly have any important bearing on the atmospheric phenomena that we are studying.

COLORADO.

The snow line, as usual, has receded nearly to the tops of the highest peaks and ranges. Hailstorms were unusually frequent and destructive. The greatest damage from this source occurred on the 6th between Rockyford and Lajunta, where all crops, excepting spring wheat, were completely destroyed. This storm took in a strip of about 5 miles wide and 12 long, being especially severe over a width of about 2 miles. The stones varied from about the size of a pea to a hen's egg and were accompanied by a severe wind; the hail was left in drifts 15 inches deep.

ILLINOIS.

Among the heaviest rains were those reported from Equality, on the 26th, about 5.50 inches in one hour, and Elgin, from 10 p. m. of the 24th until 4 a. m. of the 25th, during which 5 inches of rain fell; Riley, 9:15 p. m., 24th, to 3:45 a. m., 25th, 4.40 inches. In general, the storms throughout the month were exceedingly local in character and even in the monthly totals differences of 4, 5, and 7 inches are found for stations but a few miles apart.

IOWA.

A quotation from an anonymous exchange is given, enumerating the following cases of heavy rainfall in twenty-four hours: 31.76 inches in one day of last December at Medunkeni, in northern Ceylon; 31.17 inches in twenty-two hours at Joyeuse, France; 30 inches in twenty-six hours at Genoa; 33 inches in twenty-six hours at Gibraltar; 24 inches during one night near Bombay; 30 inches on each of five successive days on the Khasia Hills, India. The Editor will be glad to know the exact authority for these figures; they differ considerably from those given by Prof. M. W. Harrington in his article on "Central American Rainfall." In Iowa, itself, the June Review gives 7.21 inches at Greenfield, on the 9th as the largest daily amount. "Cyclones" are reported at Charles City and Dows, on page 7, but on page 8 it is said "the State happily escaped ravages by tornadoes, but was not wholly exempt from damages by severe winds." The newspapers of the country have lately spoken very freely about the frequency of tornadoes in the West Indies, by which they evidently mean hurricanes. It is to be hoped that both the section reports and the daily press will at some early future date come into harmony with the best practices of meteorologists as to the use of the words "hurricane," "typhoon," "tornado," and "cyclone."

KENTUCKY.

A meteor occurred at Maysville, on the 3d, accompanied by a rumbling noise and shock as of an earthquake. We are very glad to see the care with which this account distinguishes between the real earthquake and the meteor. It is by no means uncommon for an observer to enter "light earthquake" in his record when he might, with a little care, have ascertained that the noise and shock proceeded from a meteor or possibly a distant explosion of gunpowder.

MARYLAND.

Prof. T. J. A. Freeman, of Woodstock College, gives a very full description of a remarkable hailstorm at that place, Monday, May 16. "Clouds began to gather about 2:30 p. m.; rain began at 3:55 p. m., but in two minutes turned suddenly into large hailstones which descended for about twelve minutes, the largest being 4 ounces in weight. In a square yard one could easily have collected a coal scuttle full." This would correspond to about 30 pounds to the square yard, or an average of about 0.6 inch in depth. The hail ceased at 4:10 p. m. and heavy rain continued for about three minutes. Another heavy rain and thunder, without hail, occurred from 4:50 to 5:20. The total rainfall was 1.67 inch, whence we infer that in the first rainfall the hail constituted about one-half of the total precipitation. The exact ratio between the weight of hail and of rain that falls with it is a quantity

very much desired. In the driest climates the hail undoubtedly may be more than the rain, whereas in wet climates it is much less. The quantity of hail and of water should be measured separately when possible; taken in connection with the size of the hailstones, and the duration of the hail fall, it gives us some idea of the process going on within the thunder clouds.

MISSOURI.

Severe hailstorms seem not to have occurred, and the heaviest rainstorm was 3 inches in two hours on the 26th, at Avalon. At Rolla a severe hailstorm occurred on the 19th, 9:12 a. m. to 9:26 a. m.; the largest stones were 1.25 inch in diameter.

NEW ENGLAND.

Vernon, Vt., reports an earthquake on the 11th, at 1:25 a. m., which was distinctly felt and jarred the house. This seems to be quite an isolated case, and it is worth inquiring whether this jar was not due to something else than a true earthquake.

NEW JERSEY.

A quotation from the Trenton State Gazette states that a brilliant meteor was observed there on Wednesday evening, June 22, at 10 p. m., illuminating the northwestern sky. It is also said that "the meteor went from southeast to northeast, and left a great luminous streak across the sky, and * * * a thunderous report was heard." These and other items seem scarcely consistent with each other, but we are pleased to note that the report from New England Section states that at Middletown, Conn., at 10 p. m. of the 22d, a handsome meteor passed over this city toward the southwest. It is, therefore, evident that the meteor which passed over Middletown is the same as that observed at Trenton and Paterson. If it was seen to the northwest of Trenton, as seems most likely, and passed from northeast to northwest, instead of, as above described, from southeast to northeast, one might make an approximate computation of its altitude above the earth. The chances are that a bright meteor like this will be seen by many voluntary observers, or their friends. If every one would carefully record the apparent angular altitude and the exact bearing of the meteor at one or more points, say the beginning, or middle, or end, we should have the means of making exact computations which would be of value both to the astronomer and the meteorologist. It is by means of these bright meteors that one has been able to prove that there must be an appreciable atmosphere a hundred miles above the earth's surface, where the barometric pressure is not 0.0001 inch. The light gases at this high elevation must be entirely distinct from the gases that we know at the earth's surface.

The New Jersey report also gives an account of one of the severest thunderstorms ever experienced in that State. It came from Penn, Bucks County, Pa., adjoining Trenton, and struck the latter place about 3 p. m., and for half an hour the thunder and lightning were incessant and terrifying. It passed into Ocean County and the sea shore toward the east-southeast. All residents of the Atlantic States are familiar with the general course pursued by these afternoon and evening thunderstorms. They appear to originate to the westward near the first row of important hills or mountains, consequently on the eastern edge of the Appalachian range. They move eastward with great steadiness. Sometimes the path is toward the northeast, sometimes toward the southeast, but these are rare extremes, the average being toward the east by south. They start as great clouds, growing rapidly in size, and by the time they have moved 20 or 30 miles eastward, viz, within the first hour of their growth, they have begun to precipitate rain. Before that time the lightning and mutterings of thunder have been confined to the bosom of the cloud itself, but after that the flashes frequently strike to the earth, and sometimes strike simultaneously from cloud to cloud for a distance of 20 miles, with flashes to the earth at either extreme. These big clouds, or incipient thunderstorms, do not usually appear singly, but form an almost continuous series, stretching northeast and southeast from southeastern New York throughout the Atlantic States to Georgia. The spots at which the clouds are most likely to form can be fixed quite definitely by the statistics of the past twenty-five years. Owing to their eastward movement, at the rate of from 10 to 30 miles per hour, the whole area of the Atlantic coast States is liable to be traversed by a series of storms in the course of an afternoon, each of which is most severe in a certain central path, apparently beneath the highest portion of its cloud, while between the paths of any two neighboring storms there is a region where little or no rain falls on that day, although it may receive some on the next occasion. The presence of these so-called local thunderstorms has a slight effect upon the barometric pressure, as shown by violent and very rapid oscillations on the self-registers, but as these last but a few minutes at most, they are not likely to be observed by the use of the ordinary mercurial barometer; the aneroid is far more sensitive, and one that records by delicate optical methods shows a continual state of oscillation within a very narrow range. The wind and cloud, temperature, and especially the lightning, thunder, rain, and hail are the items demanding most careful observation and by means of which we may plot the progress of each storm, and shall, eventually, be able to predict their arrival at any place. If all the telephone and telegraph stations within a distance of 50 miles northwest and southwest of New York, Philadelphia, Washington, or any other city on the Atlantic coast were organized into a system for the immediate information of the occurrence of a thunderstorm, or even of thunder alone, the Central Office would be able to chart the location and early movement of the storm in a few minutes and predict quite exactly the time and the style of its arrival at any point. Of course, the prediction will not be in advance of the storm by more than three hours at the most, but even that amount of forewarning would be very useful in many cases.

A HIGH RAINBOW.

Mr. Sydney T. Moreland, of Lexington, Va., communicates to Nature (June 16, Vol. LVIII, p. 151) a note on a high rainbow observed on Sunday afternoon, May 29, at his residence. The sun was about an hour and a half high, at 5:40 p. m., local time (so called by him, but perhaps more accurately seventy-fifth meridian, or eastern time). The bow was in the west about 70° from the horizon, with its convex side to the sun; the colors were fairly well brought out, the red being on the convex side and the violet on the concave side. There were but very few thin clouds and no rain.

Halo phenomena in the daytime attending the sun are much more common than is ordinarily supposed. They can easily be detected by examining the region about the sun, not with the naked eye and direct vision, but either through a neutral tint glass or by looking at the reflection of the skylight in a basin of water.

We must commend Mr. Moreland and all interested in the subject to the article by Rev. K. Schipps in the MONTHLY WEATHER REVIEW, July, 1897, pp. 294–296, and also to the corresponding note by the Editor on pp. 305–306. Apparently the rainbow observed by Mr. Moreland was a circumzenithal horizontal arc tangent to the halo of 46°, while the halo itself was invisible. These halos are due to ice needles in the upper layers of the air and may attend storms without indicating any approaching change in the weather.

LIGHTNING ON THE KITE WIRE.

In the MONTHLY WEATHER REVIEW for April it was suggested that a simple method for overcoming the difficulties incident to the destruction of the kite wire by discharges of atmospheric electricity must be found before we can trust the kites in the upper regions in the neighborhood of an area of thunderstorms. Probably the first method that occurred to Professor Marvin was to substitute silk for wire. But this is evidently expensive; and as the silk cord would necessarily be of much larger diameter than the wire, there would be a proportionate injurious wind effect, diminishing the altitude of the kite. His next suggestion was the retaining of the steel wire as a whole, but inserting an occasional stretch of 50 to 100 feet of silk cord. Now, we must recognize the fact that the electric current along the wire increases rapidly from a strength sufficient to give sparks an inch long up to the destructive lightning flash. A moderate discharge or flash destroys the continuous steel wire, but a stronger flash will jump over 50 or 100 feet of silk cord and still destroy the wire, so that the introduction of the silken loop will simply delay the destructive flash for a few minutes, and does not solve the problem of perfect safety. It was, therefore, put aside by Professor Marvin almost as soon as he suggested it to the Editor.

The same idea was subsequently suggested both by Professor Rowland, of Johns Hopkins, and our amiable colleague, Dr. J. W. Kales, of Franklinville, N. Y. The latter adds that the silk cord should be covered with insulating varnish, to protect it from moisture and rain, and he adds that—

> The trouble arises from grounding the wire, thereby making it a conductor of all the electricity in the higher air. Of course the wire must be grounded at the reel. Lightning destroyed our telephone wire when it was accidentally grounded against a dwelling house. The wire was $\frac{1}{16}$ inch in diameter and 1 mile long. The house was damaged, but not set on fire.

Professor Rowland verbally stated that at first thought he saw no way to make the kite line perfectly safe, except to make it either too poor a conductor to transmit any electricity or so good a conductor that it will transmit the entire lightning flash without becoming overheated.

As any increase in the diameter of the kite line injures its efficiency as a means of carrying our meteorological apparatus to great heights, we judge that better suggestions are still in order, and that for the present it will be best not to fly the kite when thunderstorms are approaching. On the other hand, in cases of special interest, it is allowable to fly the kite even if the line is burnt up, because we have hitherto always secured the kite and its record after a little search.

CURRENTS INDUCED BY DISTANT LIGHTNING.

In the Comptes-Rendus of the Paris Academy of Sciences of June 13, 1898, page 1743, M. Ducretet says:

> I have had occasion to register the atmospheric electric discharges into the receiver at a station for "hertzian telegraphy without wires" installed at my house. The mast rises above ground to a height of 26 meters; the ground is about 55 meters above sea level. This mast dominates the neighboring houses and can be seen from a great distance. The insulated conducting wire placed at the extremity of this mast is 32 meters long; this collector of electric waves penetrates into my laboratory and is connected with one of the electrodes of the Branly radio-conductor of the receiving station; the other electrode is put to the ground.
>
> Saturday, June 11, from 2:30 to 3:40 p. m., during a thunderstorm my automatic receiver registered 311 intermittent atmospheric discharges successively as they made their presence felt upon the collector of the mast. These discharges were registered before flashes of lightning were seen or thunder heard.

We have here a phenomenon quite identical with the lightning on the kite line, as described in the MONTHLY WEATHER REVIEW for April. An insulated kite line is the conducting thread and collector of electric waves for the system of Hertzian telegraphy without telegraph lines, and in fact has already been applied for that purpose, as will be seen from the following article.

NEW USE FOR KITES—THE TELEPHONE KITE.

According to the journal Electricity some recent experiments have been made in England, in which a kite was made to support a telephone wire. Apparently the middle of the wire was fastened near the kite which was flown from a ship, as if at sea. One end of the telephone wire remained on the ship, the other was dragged by the kite a long distance to leeward until it was without difficulty dropped on the deck of H. M. S. *Dauntless*, where it was secured and attached to a telephone apparatus. In this way, vessels that are perhaps 2 miles apart can be brought into telephonic communication, and when no longer needed, the kite and telephone wire are reeled back to the first vessel without any loss. In the present case the experiment lasted four hours, during which time the kite remained suspended, held in place by the two wires and communication between the two vessels was uninterrupted.

It would seem that such a method of communicating between the shore and a vessel to windward wrecked in the breakers would sometimes be as useful as the Francis life-saving apparatus. The kite telephone, so-called, would prove especially valuable at nighttime. The same method would seem to be as practicable for carrying a telephone wire over a difficult country or forest as over the ocean, and probably as useful in war times as in time of peace.

SAFETY FUSE FOR LIGHTNING ON THE ANEMOMETER.

Mr. P. E. Doudna, voluntary observer at Colorado College, Colorado Springs, makes the following report:

> At 4:30 p. m., July 15, during a severe electrical storm, the anemometer in use here was injured by lightning. Thinking that a description of the broken instrument and an explanation of the nature of the discharge may be of interest, I submit the following:
>
> A hole was torn through the glass cover and the shattered glass thrown outside of the instrument. On the opposite side the cap which closes the oil hole was thrown out, but not injured in the least. The cups and arms attached to the spindle would not turn. On removing the cap that covers the mechanism of the instrument I found that the copper wire on the inside of this cap was fused. After working the cups a few minutes they seemed to turn as smoothly as ever. I put in a new connection to supply the place of the fused wire and used an oilcloth cover instead of the glass. The instrument was then put back in its place (a position 12 feet above the roof). The self-recorder commenced immediately to give its usual record. At first I was at a loss how to account for the peculiar nature of the injury done the instrument, but it seems to me now that the lightning must have struck the wire connecting the anemometer with the register, and fusing the wire inside the cap, which fits quite snugly and has only one small opening, created a force through the sudden expansion of the air inside the cap sufficient to shiver the glass cover of the cap, to throw the oil cap out, and to force the spindle carrying the cups so tightly into its bearings as to prevent rotation.
>
> The record which the instrument made just before the accident shows that the wind was blowing 12 miles per hour. The wire was fused just as the connection was made on a tenth mile, and instead of the customary long offset there is only a very thin line extending slightly farther out from the base line than the others.

In this connection Professor Marvin notes that the small wire that was fused is finer than the wire in the coils of the electro-magnet; it therefore melted before a sufficient current passed through to injure the coil of the magnet, and has, therefore, served as a safety fuse for the anemometer. The fact that the spindle stuck in its bearings seems to indicate that it needed oil rather than that it was the direct effect of lightning.

WHICH TREES ATTRACT LIGHTNING?

In a letter to the Chief of the Weather Bureau, Mr. Alexander McAdie, local forecast official at San Francisco, lately urged

that the Weather Bureau investigate the question why some kinds of trees are more frequently struck by lightning than others. He suggests that actual experiments with artificial lightning, such as that given by the apparatus constructed by Prof. John Trowbridge, at Harvard University, may be able to show the intrinsic differences in the effect of the discharge through different kinds of wood, and that the physicist, the Weather Bureau, the Division of Forestry, and the Division of Vegetable Pathology might combine in this study. On the other hand, Professor Trowbridge writes us that "the character of the wood, whether oak or pine, weighs but little in comparison with other physical conditions." The following paragraph quoted from Mr. McAdie's letter of February 19, 1898, will suggest lines of study to many voluntary observers:

I have the honor to invite attention to the need of an authoritative answer to the question "Why some trees are more frequently struck by lightning than others?" At first glance the subject may seem to be foreign to the work of the Weather Bureau; but investigation will show that some phases of the question are germane to the work of this Bureau and proper subjects for study.

Primarily it is a matter of saving human life; and in that direction the Weather Bureau has always put forward its best efforts. Many people, particularly farmers and those who work in the fields exposed to thunderstorms, will work until the storm is almost upon them, and then run to the nearest tree for shelter. If the tree is an oak and the charged thunder clouds are moving toward it, with high electrical potential, the person or persons under the tree are in the line of strain, and all unconsciously are contributing to the establishment of a path for the lightning discharge through themselves. Records show how frequently death results, and how dangerous it is to stand under certain trees during thunderstorms. On the other hand, if it had happened to be a beech tree, there is some reason to believe that it will afford safety as well as shelter, though the reason why is not at present known. It is known that the oak is relatively most frequently and the beech least frequently struck. If the relative frequency of the beech is represented by 1, that for the pine is 15, trees collectively about 40, and oaks, 54. Trees struck are not necessarily the highest and most prominent. Oak trees have been struck twice in the same place on successive days. Trees have been struck before rain began and split; and trees have been struck during rain and only scorched. It is plain then that before any statement is made as to the danger of standing under certain kinds of trees during thunderstorms, the more general questions of the effects of lightning upon trees should be gone into. Such a study would be best undertaken by cooperated effort of statistician, physicist, and vegetable pathologist.

The Editor hopes that those familiar with the forests in their respective neighborhoods will contribute a few words as to their own local experience in the matter of the relative frequency of lightning strokes on different kinds of trees. Of course, their statements must be accompanied by a careful estimate of the relative number or frequency of the trees themselves. Thus, if in a forest where oaks and pines are fairly well distributed, the pines are twice as numerous as the oaks, and it has been found by actual count that during any given number of years, 10 oaks and 5 pines have been struck, it will, of course, follow that the relative frequency of the lightning strokes is as 4 to the oak and 1 to the pine.

In this connection the following remarks by Mr. Austin Cary, of East Machias, Me., have just been received. Mr. Cary has had wide experience in the forests of New England, and says:

The only trees I ever noted struck by lightning were large spruce and pine and, sometimes, stubs left after a fire in burnt land. My idea was that the tall, prominent trees attracted the strokes. Pines usually stand high above the surrounding timber. I certainly think such trees are particularly liable to be struck. I have also frequently seen large spruce hit by lightning. Sometimes a narrow cut is made down the bark; sometimes big, long splinters are split out and thrown around. I do not remember ever to have seen a hard-wood tree marked by lightning. The flat crown of these trees and the comparatively even cover which a hard-wood forest presents may explain this. I learn, however, that elms are likely to be struck. This may be because they, as shade trees, stand apart.

TIN ROOFS AS LIGHTNING CONDUCTORS.

Under date of May 28, 1887, the journal of the Weather Bureau station at Little Rock, Ark., which was at that time kept by Mr. W. U. Simons, says:

A thundershower; thunder very heavy, and brilliant, zigzag and ball lightning, at times very near; night cloudy. Rossner Block struck by lightning.

In a recent letter, dated July 13, at Key West, Mr. Simons gives a fuller account of this event, as follows, having especially in view the efficacy of a tin roof as a means of protection against damage by lightning:

Mr. Fred. Rossner had recently erected a large three or four story brick building, with a tin roof, distant from the Weather Bureau office about 300 feet. During a heavy rain and thunderstorm a flash of lightning struck the roof of the Rossner building. I was standing at the office window, and, although for an instant the flash blinded me, I saw it apparently cover the entire roof with a thin blue flame, resembling alcohol burning on a flat surface. Almost immediately it appeared to flow toward the southeast corner of the building and disappeared. I learned afterward that it had passed down the waterspout at that corner of the house, and where it went to earth there was a hole in the ground about the size of an ordinary water bucket, but not a joint of either the tin roof or the waterspout had been melted. My idea of it at the time was that the rain on the roof formed such a complete covering that the electricity diffused itself through that, then followed the waterspout to the ground, using the water as a conductor.

From the preceding description it would seem that in this case the building was saved from injury, not so much by the tin roof and tin water spout as by the layer of rain water that fortunately covered the roof and filled the spout at that time. Had the roof and spout been dry, it might well have happened that every soldered joint had been melted and many a square of tin burned to destruction; under such circumstances, the building itself would have been in great danger.

RAIN GUSHES AND THUNDERSTORMS.

The article in the MONTHLY WEATHER REVIEW for July, 1897, page 303, has called forth several letters during the last year from those interested in the subject from which we quote as follows:

Prof. Milton Updegraff, Director of the Astronomical Observatory of the State University at Columbia, Mo., says:

I remember seeing somewhere the following plausible explanation of the connection between rain gushes and lightning. The large drops of rain, being formed from smaller drops of water, must be charged on their surfaces to a higher electrical potential than the smaller drops of which they are formed, for obvious geometrical reasons. Thus, a sudden and simultaneous condensation in a cloud would produce a higher electrical potential which might cause a flash of lightning which would be seen shortly before the rain drops reach the earth.

Mr. H. D. Gowey, of North Lewisburg, Ohio, remarks:

It is a general expression "that a harder rain, in general, immediately succeeds a flash of lightning or heavy thunder." I have noticed this many times in the last sixty years. If the hard thunder was about overhead then comes the harder rain, but if far distant the harder downpour for a minute or two may not come. There may be electrical attraction or repulsion between the particles of moisture that on a stroke of lightning lets them unite and fall in large drops of rain, but if no lightning so that their electricity may pass off they repel each other and not much rain falls from that cloud. In hot weather, almost invariably, if a heavy cloud arises in the west or in a westerly direction and is not accompanied by thunder then generally very little rain falls from it, but if accompanied by heavy thunder there is a heavy rainfall as long as the thunder lasts, when that ceases the rain also stops. Rain invariably follows thunder [or the thunder (and lightning) follows the rain]. Therefore, to have a "rain gush" the thunder must be overhead (in the zenith) or a little west of it. When a nimbus cloud arises in the west (in hot weather) not much rain may be expected to fall from it unless accompanied by thunder and lightning. Can not electrical attraction and electrical repulsion account for a part, at least, of the phenomena?

Prof. H. A. Hazen, of the United States Weather Bureau at Washington, says:

On Saturday, June 25, 1898, while standing in a sheltered place in this city I had an excellent opportunity for noting thunderstorm phe-

nomena. At 18*h*. 49*m*. there was a brilliant flash nearly overhead, and after an interval of seven or eight seconds there came a dash of rain which lasted about a minute. The rain had almost ceased before the next flash. Again, at 18*h*. 51*m*., there was another strong flash, and rain occurred after three or four seconds. The general rain was quite intermittent, and I noted a similar sequence twice more, but without noting the time. The impression was strong at the time that this was clearly a phenomenon of cause and effect. I have noted the same phenomenon several times before but never so markedly as on Saturday.

On comparing this record with that of Mr. Masterman on page 304, Vol. XXV, we must conclude that lightning precedes rain and follows rain with about equal frequency. Moreover, there are far more numerous cases that will have occurred to every careful observer, where severe lightning flashes have not been closely attended by a rain gush, either before or after, so that the causal connection is not only not clearly made out but is even highly improbable.

It is still too soon to announce any positive conclusion as to the connection between lightning and rainfall. Observations, suggested hypotheses, and experimental testing of the same are still in order.

THE ORIGIN OF ATMOSPHERIC ELECTRICITY.

Almost every suggestion that has ever occurred to any one as to the origin of atmospheric electricity, and the part it plays in meteorology, has been tested over and over again during the past century with only negative results. Some of these are noted in the following paragraphs:

Volta and De Saussure suggested the evaporation of the natural waters on the surface of the globe, all of which are more or less impure, but Pouillet showed that electricity could not come from the evaporation of pure water, but might come from salt water and also from the evaporating surfaces and chemical changes incident to vegetation. De la Rive showed that vegetation was entirely insufficient, and Reiss showed that evaporation of salt water does not, of itself, produce electricity; on the other hand he showed that the friction of drops of water against the sides of a platinum vessel would produce a small amount.

The hypothesis that our electricity comes from the action of the sun in heating the atmosphere as also that it is produced by the friction of warm air against cold air have both been examined, but experiment has never been able to demonstrate the slightest trace of thermo-electricity in gases and vapors.

Schoenbein considered that the oxygen of the air might act electro-chemically upon the molecules of water of which the clouds are composed, but this again has received no experimental confirmation and could hardly account for the electricity that we find in the clearest dry air. E. Becquerel suggests the decomposition of organic matters, but this, also, is not considered sufficient. It is recognized on all sides that the evaporation of terrestrial waters may carry the negative electricity at the surface of the ground upward into the atmosphere, but this does not explain the origin of that electrified state at the surface nor the fact that the atmosphere remains positive while the earth remains negative.

De la Rive considered that the continual chemical action taking place in the interior of the globe explains the origin of terrestrial electricity and that, as beneath the ocean this action is due to infiltration of sea water, therefore, the ocean is charged with positive electricity, but the solid continents with negative. Especially in the equatorial regions would the atmosphere receive from the sea those positively electrified vapors which, after overflowing into the two hemispheres, would descend in the polar regions and produce auroras, lightning, etc. But this fascinating and comprehensive theory seems to be not at all in harmony with the recent careful observations as to the nature of the electrical distribution in latitude and over oceans and continents. It is generally acknowledged that a great amount of electrified vapor and dust is carried up in every volcanic eruption, but although the quantity is enormous yet it is not sufficient to explain the condition of the whole atmosphere, although we may thereby explain some of the variations in its general electrified condition; this volcanic electricity apparently originates in a variety of ways, especially from friction.

The fact that a magnetized body when in motion gives rise by induction to an electric current flowing through a neighboring conductor has led Rowland and S. P. Thompson to calculate the electric effect of motions, such as the wind blowing over the surface of a magnetized globe, or the effect of the rotating magnetic earth upon the ether of space in its neighborhood. But here again the electric effect turns out to be too small.

The discovery by Arrhenius that sunlight, especially the ultraviolet rays, greatly diminish the insulating power of dry air and produce what is called photo-electric dissipation and the phenomena discovered by Hallwachs that a conductor carrying a negative charge gives it up to the surrounding gas when struck by a ray of ultraviolet light have given rise to the idea that in this way the sunlight acting upon one-half of the earth's atmosphere may discharge the electricity therefrom as well as from the earth and ocean beneath the air; but this, again, has not yet been demonstrated by experiment.

Faraday and Sohncke have shown that dry crystals of ice, such as may occur in the coldest dry air, may become positively electrified by friction, as for instance by descending through the air, and Sohncke has formulated a theory explanatory of the electricity of thunderstorms as dependent upon the behavior of cirrus and cumulus clouds. The electricity is generated in the region of the isothermal surface of 32° F., but this ingenious view still waits for its confirmation. Brillouin has advanced an ingenious explanation of the origin of atmospheric electricity, based upon the action of ultraviolet light upon the crystals of ice that constitute cirrus clouds (see MONTHLY WEATHER REVIEW for 1897, p. 440), but some points in his theory remain to be established by further experimentation. P. de Heen suggests that as solar radiation illuminates and heats the earth, so it also has the power to electrify the upper strata of air; that these in fact, as it were, absorb the electric influence and then being electrified act indirectly on the ground below. Maclean and Lenard have studied the electrification of the air by drops of water falling through it. It is found that falling water drops give the air a negative charge, but so also do snow crystals; therefore, the higher strata of air should be negative instead of positive, as actually observed. Marvin observes that a rain of fine drops of mercury in dry air electrifies the drops and presumably the air. Palmieri has shown that the condensation of aqueous vapor in and of itself does not develop electricity. Gay Lussac and Pouillet did the same for all changes of condition from solid to fluid to vapor to gas, and the reverse; no electricity is developed except in the change from fluid to solid, when some solids, such as sulphur, show slight manifestations which are due to the action of the edge of the solidifying liquid on the glass vessel containing it.

The inductive action of the earth on its atmosphere is undoubtedly important, but the action of the sun, distant as it is, may be appreciable. Edlund and Siemens have advocated the solar origin of atmospheric electricity, but their hypotheses have not yet been generally accepted.

The spread of the electro-magnetic telegraph lines and the electric cables over the globe has shown that local electric currents generally flowing in an east-west direction exist everywhere in the earth, thus suggesting that the electrified condition of the atmosphere depends upon them. Clerk Maxwell in his treatise on electricity after recognizing that all other

sources are insufficient suggests that possibly the changing pressures to which the earth's crust is subjected by tidal strains may give rise to piezo-electricity sufficient to explain the negative charge of the earth; the Editor quite independently of Maxwell has elaborated this hypothesis in his Preliminary Studies. The laws of these tidal strains have been studied by Chree, Davison, Darwin, and others.

The thermo-electric currents of Peltier and the piezo-electricity so fully investigated by Gaugain are not sufficient to explain the amount of electricity represented by the currents flowing through the earth's surface, but the piezo-electric currents due to tidal strain may be quite sufficient. The latter represent the conversion of gravity into electricity.

Lord Kelvin, without touching the question as to the ultimate origin of the electrified state, shows that observed phenomena are sufficiently explained by simply recognizing the fact that the atmosphere can be treated as the dielectric of a condenser (like the glass between the two sheets of tin foil in a Leyden jar); the lower or earth's surface is negative and the upper layer of the atmosphere is positively electrified.

But without pursuing further the maze of hypotheses as to the ultimate origin of the electrified state of the atmosphere, we must conclude that this problem is too difficult for immediate solution; it is one of many that a following generation of physicists will undoubtedly cope with successfully.

If we turn to the simpler question of the meteorological phenomena that are evidently associated with atmospheric electricity, we shall find that the best physicists are not yet wholly clear as to the method of formation of lightning and auroral discharges, the phosphorescent glow of the clouds, ball lightning, and other every day phenomena. Is a cloud to be considered as one big conductor or does it insulate and separate the electrified masses on either side of it? Are the great displays to be seen on the summits of the Rocky Mountains due to the influence of the atmosphere or to something going on in the earth beneath? Are large drops really made up by the agglomeration of small cloud particles, or are both the drops and electricity formed simultaneously by the sudden dissipation of unstable molecular equilibrium that exists in supersaturated cloudy air (as suggested by the Editor in his article of 1891 in "Agricultural Science" on the "Artificial Production of Rain")? Do the larger drops of rain really possess a greater electrical density on their surfaces than the small drops and particles, or do they not rather lose their charges immediately either by evaporation or by gentle discharge to the neighboring drops? These and other questions crowd upon our thoughts; but satisfactory replies can only be given after physicists have invented appropriate methods of investigation. Meteorological observers may contribute to the solution of the problems by collecting both general data and special observations of exceptional phenomena, but the discussion of the data and the definitive decision by means of experimentation as to the merits of conflicting hypothetical explanations must be left to the leading physicists of the world.

ANOMALOUS AND SPORADIC AURORAS.

The Editor regrets that the publication of the following interesting communication has been delayed somewhat by the accumulation of material for the MONTHLY WEATHER REVIEW.

In a letter, dated Key West, November 10, 1897, Mr. H. B. Boyer, observer, Weather Bureau, said:

I have the honor to report that the following described phenomenon was observed on the 8th instant, and it is requested that its character be determined, if possible. The description is taken from the daily journal:

A singular phenomenon was observed between 9 and 10 p. m. This consisted of a beam of well-defined light stretching across the sky, similar to the rays projected by an electric search light. At first it was thought that such it was, as there are two men-of-war in the harbor; but the position and permanency of the beam precluded this idea, and it was afterwards found that the phenomenon had been noted on the war vessels. * * *

The luminous beam began at a point in azimuth 230° (counting from south to west) and stretched southward across the heavens to a point in azimuth 330°, with a slight upward tendency and a slight widening. At its northern extremity its width was about ½°, broadening to about 1° at its southern extremity. It remained fixed as regards its position relative to terrestrial objects, and it was noted that stars, in their upward course, were plainly visible through it. The inclination and altitude may be determined from the following: As the constellation of Orion passed the beam it was observed that at 9:50 p. m. the uppermost star in the "belt" and "Rigel" passed through simultaneously; in other words, a line drawn from "Rigel" to the uppermost star in the "belt" of Orion coincided with the axis of the luminous beam. The phenomenon began to fade about 9:45 p. m., and by 10:10 p. m. had disappeared, the fading process beginning at the northern end. By some the beam was seen to vibrate.

The above phenomenon of November 8, 1897, at Key West, occurred at a time when auroras were rarely observed (see the MONTHLY WEATHER REVIEW for November, 1897, Table IX, p. 513), but at the same time, according to that table, thunderstorms were unusually frequent, and the total number of reports for the whole United States was 64 on that day, being the largest number that occurred during the month; 38 thunderstorms were reported on the 7th and 59 on the 9th, so that these three days present us with one-third of all the storms that occurred during the month.

The general distribution of the reported thunderstorms on the 7th, 8th, and 9th was as follows: Illinois, 6, 15, 1, respectively; Indiana, 0, 9, 8; Missouri, 12, 8, 0; Ohio, 2, 13, 13; New York, 0, 2, 11; New Jersey, 0, 0, 8; Pennsylvania, 0, 3, 9; Tennessee, 0, 5, 1; Connecticut, 0, 0, 4; Massachusetts, 0, 0, 4. Other States report one or two only and Florida reported none. Even in Canada thunderstorms were reported at Grand Manan on the 6th and 9th.

General notes relative to the relation between lightning and auroras and anomalous phenomena relating to atmospheric electricity will be found in different numbers of the MONTHLY WEATHER REVIEW, the principal references to which are as follows: 1893, XXI, pp. 291, 292; 1894, XXII, pp. 78, 328, 509; 1895, XXIII, pp. 13, 297, 464; 1896, XXIV, p. 333.

The item on page 297 of the MONTHLY WEATHER REVIEW for August, 1895, is almost a parallel to the case reported by Mr. Boyer at Key West. It describes an auroral arch and streamer, as seen at Charleston, S. C., on August 26. The phenomenon was so unusual as to have given rise to many suspicions, but eventually it was seen there could be no doubt that this was a case of a very local aurora, such as the Editor calls "sporadic auroras," occurring beyond the confines of a region in which thunderstorms were prevailing at the time. These sporadic and local auroras must be considered as one of the mildest forms of electrical discharge in the atmosphere. It may be that the electricity distributed all over the surface of a globule of water in a cloudy mass or in a hazy sky is collected at the extremities of the spicule of ice when that globule is frozen. The auroral light therefore emanates from definite points and lines located near or above that layer in the atmosphere at which freezing temperature has just occurred. (Small globules may cool far below 32° F. before they freeze to ice needles.) This may be, and undoubtedly is a very irregular surface, but must have a close analogy to the shapes that we see depicted in the clouds and auroras themselves. The beautiful streamers of cirrus haze, as observed in the daytime, have often been compared with the beams, arches, and folds of auroral light, as seen at nighttime. It is quite plausible that both at Charleston, August 26, 1895, and at Key West, November 8, 1897, a discharge of electricity was taking place horizontally outward in all directions from an area of low pressure or

cyclonic disturbance central in the Ohio and Mississippi watersheds. The storm area was particularly well marked on November 8, 1897, as it moved from Illinois to the St. Lawrence Valley, and the system of south and west winds on its southeastern side extended as far as the southern stations in Florida, excepting only Key West. Above these lower winds were the cold westerly upper currents. The region of numerous thunderstorms attending this area of low pressure extended from Illinois to Massachusetts and southward to Tennessee, as shown by the figures above given. Occasional sporadic thunderstorms were reported on the 7th, 8th, and 9th, as follows: Arkansas, 0, 1, 0; Kansas, 2, 1, 0; Louisiana, 0, 2, 1; Kentucky, 0, 2, 0; Maine, 0, 0, 2; Maryland, 0, 0, 2; Michigan, 0, 2, 0; Mississippi, 0, 1, 0; Nebraska, 2, 0, 0; New Hampshire, 0, 1, 1; Rhode Island, 0, 0, 1; Texas, 0, 1, 0; West Virginia, 0, 0, 1. There is, therefore, no reason to doubt but that the disturbed electrical condition extended southeastward from the storm center into Florida, although of course the intensity of the disturbance in that region may have been exceedingly feeble. The temperature at Key West ranged between 65° and 75°, and one would, therefore probably have to ascend 10,000 feet before coming to a temperature of 32°. Between Key West and the storm center the whole country was covered with warm southerly winds, and the height of the isotherm of 32° may have been even more than 10,000 feet. In this region the disturbed electrical condition was relieved by the lightning flashes of the numerous thunderstorms. The air that was not thus suddenly brought to electric equilibrium could, by retaining some of its electric charge, eventually give rise to an aurora when its free electricity was being silently dissipated in gentle streams from the points of snow crystals and their elementary spiculæ.

MOONSHINE AND FROST.

Referring to an article under the above caption in the MONTHLY WEATHER REVIEW for March, 1898, Dr. J. W. Kales, M. D., Franklinville, N. Y., says:

The idea conveyed in that article is that frosts occurring before full moon are not injurious to vegetation, while frosts occurring after the full moon may be injurious.

During the night of May 12-13, 1895, a frost occurred in this section of New York State. It completely destroyed the grass crop and all growing crops; even killed the leaves on the trees, and in some places killed the trees. The leaves turned as brown as in October, and the meadows were as bare of grass as in September. In a word, it destroyed every kind of vegetation. The effects of this frost are still felt throughout this section. The full moon occurred on the evening of the 18th of May, 1895.

These facts are not in accord with this moon theory. Hence, like the other moon theories, this one is all "moonshine."

WATERSPOUTS.

The following extracts from newspapers refer to some special features of waterspouts which it is desirable to put on record.

From the Daily Globe, of June 21, Pensacola, Fla., we take the following:

On Monday, June 20, in the morning, a spout formed on the west side of Pensacola Bay, near Black Hammock, in the shape of a little whirl, and started across the bay in a straight line, gathering force and volume as it went, until it struck on the east bank, near the mouth of East Bay, where upon a sudden it seemed to make connection with an immense black funnel-shaped cloud, forming a complete tube to the water, which it sucked up in immense quantities. The rotary motion of the cloud or spout twisted off the tops of the pines, and they could be seen going up the spout as through an immense glass tube, the water and tree tops rushing up with fearful velocity, when of a sudden it [the spout] seemed to lift from the water, and, with a swiftly rolling motion, gradually drew up into the cloud, whither it gradually spread and disappeared over the expanse of sky.

Those who witnessed this immense waterspout state that it was the largest and most perfect one ever seen in these waters.

From the Press, July 19, Cleveland, Ohio, we take the following:

A remarkable cloud formation appeared in the northwest sky over the lake late in the afternoon of Monday, July 18. It was large and black and boiled and whirled in an angry manner. The shape was that of a cone lying on its side instead of point down like a tornado cloud. Above and beneath the threatening inky cloud the bright sun shone. Shortly after the cloud's first appearance the sky became fully overcast and a heavy rainfall ensued. The whirling motion possessed by the cloud was almost at right angles to that of a waterspout, since in the latter the point of the cone extends nearly straight downward.

PERIODIC FLUCTUATIONS OF THE GREAT LAKES.

Mr. F. Napier Denison, of the Meteorological Service of Canada, and who has just been assigned to duty in British Columbia in order to build up a forecast system for that region, has lately published in the Canadian Engineer a paper on the "Great Lakes as a Sensitive Barometer." Mr. Denison seems to have begun the detailed study of the subject in 1896, and at once proceeded to construct a self-recording gauge showing the fluctuations of Lake Ontario at the mouth of the Humber River, 3 miles west of Toronto, on quite a large scale as to time and amplitude, viz, 1 inch of paper for an hour of time and a quarter of an inch of paper to an inch of fluctuation of the water level. A second self-recording apparatus was subsequently set up in September, 1896, at the Burlington Canal, at the southwest extremity of Lake Ontario, about 40 miles from Toronto. The records given by Mr. Denison's instrument are on a somewhat larger scale than those of the ordinary tide gauge, and in its latest construction Mr. Denison has added another record equivalent to that of a water barometer. Thus, on the same recording sheet we have the records of atmospheric pressure, and, therefore, the ability to make a minute comparison between this and the lake level.

1. Mr. Denison finds that when the lake record is least disturbed, so also is the barometric trace.

2. When the lake undulations become large and rapid so do the oscillations of the atmospheric pressure.

3. The larger undulations in the lake have a period that averages twenty minutes, and the smaller ones average ten minutes.

4. The lake level is never stationary, but the smallest movement recorded for twelve consecutive hours was from one-half to one inch when the pressure trace was also very quiet.

5. Mr. Denison further concludes that the longitudinal and transverse seiches in Lake Ontario are due to great differences of atmospheric pressure between the extremities of the lake, which differences are doubtless augmented when the gale strikes the surface of the water. The longitudinal seiche has a period of four hours and forty-nine minutes, but the transverse seiches only forty-five minutes. When the isobars, as shown on the daily weather maps, lie parallel with the axis of the lake, the seiche movement becomes almost imperceptible. These seiches appear shortly before the passage of some severe storm and for several days thereafter.

6. The rapid heaping up of the water at the upper end of the lake, which is due to great differences of pressure in conjunction with the action of the wind, sets up powerful currents at the top and bottom of the lake, and after this disturbance of water level is over the seiche or oscillation of the whole lake begins.

7. In connection with Helmholtz's paper on atmospheric billows Mr. Denison suggests that the smaller undulations are due to the direct action of the atmospheric waves or billows as they move over the surface of the lake.

8. That these undulations in the lake level become rapid and of great amplitude during fine weather and rising or

stationary barometer, when an important area of high pressure is central over the Southern States.

9. That "the tidal waves," falsely so called, especially for Lake Erie, are due to large and rapid changes in atmospheric pressure such as are noticeable upon the barograph preceding or during thunderstorm conditions.

10. That the larger lake undulations may account for the existence of the greater waves encountered by fishermen and often termed the "three sisters."

The author adds that similar results to these for the lakes have been obtained by him from the study of the tidal records at St. John, N. B., and Halifax, N. S., and he is quite enthusiastic as to the useful results that may be attained in weather forecasting when such tidal records on the lakes and on the western seaboard are submitted to careful study.

Mr. Denison had the kindness to bring to the Weather Bureau samples of his interesting and valuable records, but after some consideration of the subject the Editor was forced to the conclusion that his large scale barograph curve will of itself be more useful in the study of and prediction of the weather than the record of the lake levels, which latter is full of fluctuations due to seiches and shorter waves and has no very close relation to the barograph or to the curve of air pressure. The study of the seiche is an important matter in the study of lake levels and engineering projects, but does not seem to be especially essential to meteorology.

HISTORIC DROUGHTS IN THE UNITED STATES.

From two well-known volumes (Peirce, "On the Weather," Philadelphia, 1847, page 272, and Perley, "Historic Storms," Salem, 1891, pages 58 and 66) we learn something about two of the severest droughts on record. The meteorologist will find it an interesting problem to explain, even in a general way, the reasons for these great departures from normal conditions.

1749. The spring was uncommonly dry, and by the end of May pastures were all scorched and burned in eastern Massachusetts. The drought probably continued longer and was felt more severely than any one that the people had before experienced. June 9 was appointed as a day of public fasting and prayer. Between July 1 and 6 plenty of showers fell in New England, and the period of drought was brought to an end. A small crop of hay, barley, and oats and a good crop of indian corn were harvested; flax and herbs of all kinds were a failure; cattle were killed in the autumn to save the great expense of keeping them through the winter.

1762. There was scarcely any rain from April 9 to August 18, and in some places, as at Danvers, until September 22. The month of April was cold. There was a slight drizzling rain at Boston May 7 and June 3 and showers on June 18. July 7 a fast was held at Falmouth, Me., and at Milton, Mass. July 28, being fearful that a famine would ensue, a public fast was proclaimed in a number of cities. Refreshing showers occurred near Falmouth, but not elsewhere until August 18, when bounteous rain descended throughout New England. Crops were, of course, very light and cattle were generally slaughtered because of the difficulty of keeping them through the winter.

1816. This summer, which is known as the cold one, was also a very dry one in many regions. In Vermont no rain fell during May and very little in Connecticut. During June intense heats were followed by freezing weather, with snow squalls in several of the New England States. The snowfall on the 8th of June in Vermont amounted in some places to 12 and 18 inches. In July there was abundant rain in northwestern Massachusetts and New Hampshire; from that time a drought continued until October 22, having prevailed for one hundred and twenty days in Vermont. Owing to the cold and the drought the crops were an almost complete failure.

Our scanty records make it quite impossible to present a really satisfactory summary of the meteorological conditions that prevailed during these historic droughts, but it is sufficiently evident that any locality between Pennsylvania and Maine may count upon having an absolute drought of three months' duration at least once in a century and injurious droughts of a month's duration very much more frequently. It is by no means impossible for the farmer to secure admirable crops during such droughty seasons if he will make proper provision for artificial irrigation. It is much more business-like to profit by past experience and provide artesian wells, windmill water pumps, protected reservoirs, and irrigating ditches than to neglect all these and spend one's time in praying for rain. Fast days and prayers were all right for the early settlers of the country, before they knew the exact nature of our climate, but now that three hundred years of records have accumulated and we know or ought to know how to succeed in the struggle against the inexorable laws of nature, it behooves us to profit by our experience. New England farmers have been very slow to realize the profit that is to be drawn from a parched soil and a cloudless sunny sky by the simple means of irrigation. Methods of cultivation that have made the desert spots of central Asia, Algeria, northern India, Australia, and California profitable gardens have until lately been ignored in New England.

INTERNATIONAL BALLOON ASCENSIONS, JUNE 8, 1898.

The fifth series of international simultaneous balloon ascensions came off on the morning of June 8, with great success. The following brief summary is condensed from the full account that is published in Ciel et Terre, July 1, Vol. XIX, p. 203.

Owing to the interest in the subject, stimulated by the conference at Strasburg (see MONTHLY WEATHER REVIEW, November, 1896, pp. 365, 415, and 462, and April, 1898, p. 158), six nations, Austria, Belgium, Italy, France, Germany, and Russia took part in this most important meteorological campaign. The Daily Weather Map for Europe shows that on the morning of June 8 the isobar of 765 mm. covered central Europe with a very irregular curve, and that a pressure as low as 760 could only be found by going far to the west and south. Consequently, the most gentle barometric gradients prevailed throughout the region represented by the balloon ascensions, and very slight changes in pressure and temperature occurred during the twenty-four hours. Light rains had fallen on the immediate coast of the North Sea during the night before, and were again repeated during the following night, but the interior of the country was everywhere clear or partly cloudy, with rare cases of local thunderstorms. The morning temperatures ranged from 12° to 16°, the maximum temperatures 16° to 25° C., over this part of Europe. The operations at each station were as follows:

Vienna.—One sounding balloon and three ordinary military balloons, manned by officers of the army, were sent up successively at 6, 7, 8 a. m., and the last one at noon. The latter reached an altitude of 4,500 meters, where the temperature was —8° C.

Berlin.—Four balloons started, respectively, at 6 a. m., 9 a. m., and noon, and the last at 2 a. m. the next morning. Of course the winds near the ground were light and baffling, but the balloons moved slowly toward either west-northwest or west-southwest, according to their altitudes.

Paris.—The sky was so foggy in the morning that the sounding balloon could not be observed at the theodolite sta-

tions, and the ascension was, therefore, delayed. One balloon started at 10:05 a. m. from Paris, and descended at 4 p. m. in Westphalia, having attained a height of from 14,000 to 16,000 meters, where the temperature was —64° C.

Paris.—The great sounding balloon of 465 cubic meters capacity was sent up from Paris by the French Aerostatic Committee and carried a self-registering actinometer of Violle's construction. This actinometer registered perfectly. It furnishes a continuous clear line upon which we see depicted all the events of the ascension; the departure in cloudy weather, the passage through the clouds, the attainment of the highest point in less than three-quarters of an hour, then a very slow descent during several hours, finally the very rapid descent that brought the balloon to the ground after a sojourn of eight hours in the atmosphere. During the whole of the highest horizontal soaring the black bulb of the actinometer had a constant temperature of —12° C., or about 50° above that of the surrounding air. This actinograph record has apparently given results that are not entirely accordant with current ideas on the subject; it shows that actinometry by means of these atmospheric soundings will give us a better knowledge of solar radiation and atmospheric absorption.

The automatic photographic apparatus of Cailletet, for determining the altitudes, recorded the pressures in an excellent manner, but owing to the cloudiness could not give a direct measurement of altitude.

Trappes near Paris.—Three sounding balloons adjusted to explore different layers in the atmosphere were sent up from the meteorological observatory of M. Teisserenc de Bort. The first started at 3:03 a. m., attained 12,500 meters, with a temperature of —60° C., and was carried by the upper cirrus current toward north 35° east. The second started at 4:55 a. m., attained 9,000 meters, with a temperature of —42°, and traveled northward. The third started at 7:55 a. m., attained 6,800 meters and a temperature of —21°, and traveled toward the north-northwest. The lowest wind blew from the east-southeast, so that the successive upper currents were steadily deflected from this direction toward the right up to the highest, which moved toward the north 35° east.

Strasburg.—A sounding balloon and a manned balloon, as well as a balloon-kite, were used. The latter remained up during twenty-four consecutive hours. The sounding balloon started at 8:30 a. m., moved easterly, attained an elevation of 11,000 meters and a temperature of —50° C.

Brussels.—An ordinary balloon ascended to 1,500 meters.

Berlin.—The balloon manned by Berson started at 2:38 a. m. and descended at 4:15 a. m. During this one hour and thirty-seven minutes, it traveled 160 km. and attained an altitude of 5,500 meters. The balloon manned by Suring attained about 5,300. The balloons manned by Captain Gross and Lieutenant Siegsfeld, respectively, attained about 4,500 meters. Berson found a temperature of —12° C. at 5,500, while Siegsfeld found —8° at 4,500 meters. But, of course, these preliminary results will be changed by subsequent comparison of thermographs. In all manned balloons the temperatures have been observed by means of Assman's ventilated thermometer.

Of the seven sounding balloons, five had been heard from when the report was written. One of the French sounding balloons carried, for the first time, an actinometer, and also Cailletet's photographic altitude apparatus (see the MONTHLY WEATHER REVIEW for October, 1897, p. 443).

Aerophile No. 3, leaving Paris at 2:30 a. m., fell into the hands of some kind-hearted but ignorant persons, who thought that the blackened surface of the cylinder on which the record was registered had been unfortunately blacked by smoke, imagining that the balloon was a *montgolfière* or hot-air balloon, and that the aeronaut had been killed by the combustion of the balloon. They, therefore, thought that they were doing a kindness to clean up the cylinder and polish off the thin layer of lampblack. When Teisserenc de Bort arrived to claim his priceless record, he found the cylinder shining like new, but with no trace of the delicate lines that the stylus had traced when high up in the ethereal blue. However, the kind people gave the aeronaut a charming reception.

Something similar happened to the Parisian balloon that descended in Westphalia. These incidents show that the popular daily journals have not as yet explained the theory of the sounding balloon with sufficient fullness. They show furthermore that Moedebeck, of Vienna, did well to attach to his sounding balloon a strip of cloth a meter broad and six meters long, on which he painted the proper notice in large letters in German, French, Russian, Magyar, and Turkish.

THE SMITHSONIAN WEATHER PREDICTIONS.

An interesting contribution to the history of weather telegraphy in the United States and the development of our knowledge of American meteorology is published on pp. 271–275 of the Proceedings of the American Academy of Arts and Sciences, Vol. IV, for the years 1857–1860. On August 9, 1859, Prof. Joseph Henry, Secretary of the Smithsonian Institution, addressed the Academy on the above subject; probably the published account is generally expressed in his precise words, but there is evidence that it was prepared, at least, in part by the recording secretary of the Academy, Samuel L. Abbot, or by the publication committee whose chairman was Prof. Joseph Lovering, a well-known authority in magnetism and meteorology. The following is a copy of the published record and any additional facts will be gratefully acknowledged by the Editor.

Professor Henry, of the Smithsonian Institution, made a verbal communication relative to the application of the telegraph to the prediction of changes of the weather, particularly in the city of Boston and its vicinity.

It has been fully established by the observations which have been made under the direction of the Smithsonian Institution, and from other sources of information, that the principal disturbances of the atmosphere are not of a local character, but commence in certain regions, and are propagated in definite directions over the whole surface of the United States east of the Rocky Mountains.

From a careful study of all the phenomena of the winds of the temperate zones, it is inferred that over the whole surface of the United States and Canada there are two great currents of air continually flowing eastward. These currents consist of an upper and a lower, the former returning the air to the south which was carried by the latter towards the north. The lower current, which is continually flowing over the surface of the United States, is about 2 miles in depth, and moves from the southwest to northeast. The upper or return current. which is probably of nearly equal magnitude, flows from northwest to southeast, or nearly at right angles to the other, and the resultant of the two is a current almost directly from the west. The reaction of these two currents appears to be the principal cause of the sudden changes of weather in our latitude. They give definite direction to our storms, accordingly as the latter are more influenced by the motion of the one or the other of these great aerial streams. The principal American storms may, from our present knowledge, be divided into two classes; namely, those which have their origin in the Caribbean Sea, and those which enter our territory from the north, at the eastern base of the Rocky Mountains. Those of the first class, which have been studied with much success by the lamented Redfield and others, follow the general direction of the Gulf Stream and, overlapping the eastern portion of the United States, give rise to those violent commotions of the atmosphere which are in many instances so destructive to life and property along our eastern coast. These storms from the south are frequently two or three days in traversing the distance from Key West to Cape Race, and their approach and progress might generally be announced by telegraph in time to guard against their disastrous effects. Though the general direction of these storms appears to be made out with considerable certainty, much remains to be done in settling the theory of their character and formation.

The materials which have been collected at the Smithsonian Institution during the last seven years relative to the other class of storms have enabled us to establish general facts of much value not only in a scientific point of view but also in their application to the prediction of the weather. (This statement was verified by a series of maps ex-

hibited to the Academy by Professor Henry, on which were indicated the beginning and progress of some remarkable changes of weather.) From these maps it appears that the great disturbances of the atmosphere which spread over the surface of the United States enter our territory from the possessions of the Northwest Company, about the sources of the Saskatchewan, at the base of the Rocky Mountains, and are thence propagated south and east until in many instances they spread over the whole of the United States and probably a large portion of the British Possessions.

For example, the great depression of temperature which occurred in January of the present year [1859] and which will be remembered by every one as the most marked cold period of the season entered the territory of the United States at the point before mentioned on the 5th of January, and on the 6th reached Utah, on the 7th Santa Fe, and on the 8th the Gulf of Mexico, and passing onward it was felt at Guatemala on the 10th. While it was advancing southward it was spreading over the continent to the east. On the 7th it reached the Red River settlement, and all places under the same meridian down to the Gulf of Mexico. It reached the meridian of Chicago on the 8th, the western part of the State of New York on the 9th, New England on the 10th, and Cape Race on the 13th. It moved with about equal velocity over the Southern States, and was observed at Bermuda on the 12th.

The remarkable frost of last June, so far as it has been traced, had the same origin, and followed the same eastward course. The fact was also illustrated, by the maps before mentioned, that the warm periods which have occurred in past years have followed the same law of progression, and consequently their approach could have been announced to the inhabitants of the Eastern States several days in advance, had a proper system of telegraphic dispatches been established.

The value of the telegraph in regard to meteorology has been fully proved by the experience of the Smithsonian Institution. The Morse line of telegraph has kindly furnished the Institution during the last twelve months [1858 and 1859], free of cost, with a series of daily records of the weather, from the principal stations over the whole country east of the Mississippi River and south of New York. In order to exhibit at one view the state of the weather over the portion of the United States just mentioned, a large map is pasted on a wooden surface, into which, at each station of observation, a pin is inserted, to which a card can be temporarily attached. The observations are made at about 7 o'clock in the morning, and as soon as the results are received at the Institution, an assistant attaches a card to each place from which intelligence has been obtained, indicating the kind of weather at the time; rain being indicated by a black card, cloudiness by a brown one, snow by a blue one, and clear sky by a white card.

This meteorological map is an object of great interest to the many persons from a distance who visit the Institution daily. All appear to be specially interested in knowing the condition of weather to which their friends at home are subjected at the time. But the value of the map is not confined to the gratification of this desire. It enables us to study the progress of storms, and to predict what changes in the weather may be expected at the east from the indications furnished by places farther west. For example, if a black card is seen in the morning on the station at Cincinnati, indicating rain in that city, a rainstorm may confidently be expected at Washington at about 7 o'clock in the evening. Indeed, so uniformly has this prediction been verified that last winter [1858–59] the advertising in the afternoon papers of the lecture to be delivered at the Institution that evening was governed by condition of the weather in the morning at Cincinnati, a rainy morning at the latter inducing a postponement of the lecture.

It must be evident from the facts given that if a system of telegraphing over the whole country east of the Rocky Mountains were established, information could be given to the Middle and Eastern States of the approach of disturbances of the atmosphere of much value to the agriculturist, the ship owner, and to all others who transact business affected by changes of weather, as well as of importance to the invalid and the traveler. Indeed, with a proper combination of the lines now in operation, daily intelligence might be obtained in the city of Boston which would be of the highest interest to its inhabitants. Professor Henry mentioned Boston in particular, because this city is so situated that the storms, both of the southern and western class, reach it after they have been felt in New York and in other places which are not as far east and north. It is necessary to remark that the same use of the telegraph is in a measure inapplicable to the inhabitants of western Europe, since they live on the eastern side of an ocean and can not be apprised of the approach of storms from the west. For the same reason the general laws of storms are more conveniently studied by the meteorologists of this country than by those of Great Britain and France.

It should be distinctly understood that the remarks which have been made in this communication relate to the more violent changes of the weather which occur in autumn, winter, and spring. The thunder showers which occur almost daily during the warm weather in summer have somewhat of a local character, and commence at the same time, and frequently at the same hour, for several days in succession, at the same and different places, but wherever they commence they move eastward over the country until they are exhausted.

Professor Henry also spoke of the facts collected in regard to the nature of American storms, and their connection with the two great aerial currents continually flowing over the temperate zone. He considered that the great changes of the weather are principally due to the gradual production of an unstable equilibrium in the two currents, by the accumulation of heat and moisture in the lower.

He spoke in high terms of the importance of the labors of Mr. Espy in developing the theory of the upward motion of air, and the evolution of latent heat in the production of storms.

In reply to a question as to the possibility of crossing the Atlantic in a balloon, the Professor stated that he had little doubt, if the balloon could be made to retain the gas, and to ascend into the upper current, it would be wafted across the ocean in the course of three or four days. If it descended into the lower current, it would be carried to the north of east; and if it continued in the upper current, it would reach Europe south of the same point. The course could be changed, within certain limits, by ascending and descending from one current to the other. The late balloon voyage from St. Louis to Jefferson County, N. Y., was of interest in confirming the theoretical direction of the great lower current of this latitude.

BROUN'S LAW OF WINDS AND CURRENTS.

In December, 1871, while in the midst of forecast duty and of an intense study of every observational feature of atmospheric circulation, the Editor had the good fortune to receive a visit from the veteran aeronaut, Samuel A. King, from whom he obtained the loan of a volume of newspaper cuttings describing many of his aeronautical voyages. From this volume he prepared for Mr. King the tables presented on December 16, 1871, published on pages 36–38 of the Bulletin of the Philosophical Society of Washington, Vol. I. The object of this compilation was to show the direction of each of the currents of air into which the balloon ascended on the respective voyages. On that occasion the Editor called attention to the fact that it is rare to find an upper current in a direction opposed to the lowest or surface wind, the deviations being usually between 90° and 135°, but as the balloon ascended but little more than 10,000 feet these records only give us an insight into the nature of the lower system of currents that precede extended storms; the ascensions were made by preference only in the settled, pleasant weather attending areas of high pressure and in the warmer season of the year.

Even before this publication the Editor had been studying the direction of upper clouds, as telegraphed daily to Washington, and displayed on the maps used by him in making up the tridaily "probabilities" of the Signal Service, and had perceived the general and almost invariable rule that the upper cloud directions lie to the right of the lower clouds, and the latter to the right of the winds. In a letter of February, 1872, he said:

> The upper clouds move toward a point on the right-hand side of that toward which the surface winds blow; the angle between these two directions varies from 0 to 180° but is, in a majority of cases, 90°.

This generalization leads to a very simple theory of the upper currents within areas of low pressure, the so-called cyclonic inflow of the winds below and anticyclonic outflow of the cirrus clouds above.

A few months later the Editor stated: "This is evidently only another way of saying that the upper clouds move away from areas of low pressure," and illustrated this by the following five tables for the motions of cirrus and cumulus clouds prepared for Washington, during the months of January to June, 1872.

Tables I and II show, respectively, the number of times that clouds were observed from a given direction when a given surface wind prevailed. The compilation of such tables is a mere matter of counting. Thus, with a northwest wind, cirrus clouds were observed moving from northwest 16 times out of the whole 118 cases.

Table III shows how much any cloud direction deviates to the right (plus) or to the left (minus) from any wind direction. Applying this general table to the data in Tables I and

II, we get the results given in Tables IV and V, which show that the average amount of deviation of the cirrus cloud to the right of the wind is 27.6°, while the average amount for the cumulus clouds or lower currents is only 4.6°.

Comparison of directions of movements of clouds and winds, at Washington, from January to June, 1872.

I.—CIRRUS CLOUDS.

Wind.	Clouds.								Sums.
	S.	SW.	W.	NW.	N.	NE.	E.	SE.	
S.	6	9	5	6	.....	.....	2	1	29
SW.	.....	8	1	1	.....	1	1	.....	12
W.	.....	2	7	1	.....	.....	.....	1	11
NW.	.....	5	3	16	2	4	1	3	34
N.	.....	2	3	1	2	.....	.....	2	10
NE.	.....	.....	.....	.....	.....	2	1	.....	3
E.	1	.....	1	.....	.....	1	.....	.....	3
SE.	.....	4	3	6	.....	1	.....	2	16
Sums.	7	30	23	31	4	9	5	9	118

II.—CUMULUS CLOUDS.

Wind.	Clouds.								Sums.
	S.	SW.	W.	NW.	N.	NE.	E.	SE.	
S.	5	9	4	2	1	3	1	.....	25
SW.	.....	7	5	.....	.....	.....	.....	.....	12
W.	.....	6	18	8	.....	.....	3	2	37
NW.	2	10	14	54	1	2	3	5	91
N.	.....	1	11	.....	3	1	.....	.....	16
NE.	.....	.....	.....	5	.....	3	.....	.....	8
E.	.....	.....	1	.....	.....	.....	.....	.....	1
SE.	.....	6	7	1	.....	1	.....	5	20
Sums.	6	39	60	70	5	10	7	12	210

III.—GENERAL TABLE FOR COMPUTING THE DEVIATION OF CLOUDS FROM WIND IN TERMS OF 45° AS UNIT ANGLE.

+ = to the right. − = to the left. x = directly opposite, or 4 times 45°.

Wind.	Clouds.							
	S.	SW.	W.	NW.	N.	NE.	E.	SE.
S.	0	+1	+2	+3	x	−3	−2	−1
SW	−1	0	+1	+2	+3	x	−3	−2
W.	−2	−1	0	+1	+2	+3	x	−3
NW.	−3	−2	−1	0	+1	+2	+3	x
N.	x	−3	−2	−1	0	+1	+2	+3
NE.	+3	x	−3	−2	−1	0	+1	+2
E.	+2	+3	x	−3	−2	−1	0	+1
SE.	+1	+2	+3	x	−3	−2	−1	0

IV.—CIRRUS CLOUDS. JANUARY TO JUNE, 1872.

Summary of deviations.

	Times.	
Clouds move with wind	43	
Clouds deviate 45° to right	14	
Clouds deviate 90° to right	15	41
Clouds deviate 135° to right	12	
Clouds opposed to wind	11	
Clouds deviate 135° to left	4	
Clouds deviate 90° to left	11	23
Clouds deviate 45° to left	8	
	118	

V.—CUMULUS CLOUDS. JANUARY TO JUNE, 1872.

Summary of deviations.

	Times.	
Clouds move with wind	95	
Clouds deviate 45° to right	24	
Clouds deviate 90° to right	12	48
Clouds deviate 135° to right	12	
Clouds opposed to wind	11	
Clouds deviate 135° to left	8	
Clouds deviate 90° to left	28	56
Clouds deviate 45° to left	20	

It was on the basis of such computations as this that the Editor framed a recommendation embodied in his paper on the "Marine nephoscope and its usefulness to the navigator" (see the Report of the International Meteorological Congress at Chicago in 1893, Part I, p. 163):

As a result of the work that has hitherto been done on this subject, I think we may for the present adopt the general rule that between the winds blowing spirally inward and the upper clouds blowing spirally outward there is an intermediate layer of the so-called lower clouds, whose motion is very nearly along a circular arc, and that the mariner may more safely locate the storm center as being in a line perpendicular to the motion of the lower clouds, rather than to rely entirely upon the surface winds.

Even Redfield had stated that the average inclination of the lower clouds to the circle around the storm center, as deduced from his own observations in New York City, was less than the inclination of the winds and averaged only 7°.

The generalization above given by the Editor was, in fact, often expressed by him in a more general way, as follows, viz, that the higher we ascend in the atmosphere, so much the more does the direction of the wind or currents deflect to the right, a rule that has, perhaps, sometimes been called Ley's law.

The difference in direction of the upper and lower currents of air, which is sometimes referred to as Ley's law, was, we believe, first published by him in his Laws of the Winds Prevailing in Western Europe, Part I, London, 1872. On page 149 he says:

Owing to this and other difficulties, no attempts appear to have been hitherto made to systematize the results of upper current observations with a view to ascertain the relations existing between the directions and velocities of such currents and the distribution of pressures at the earth's surface.

He then gives some account of his own observations on the true cirrus clouds, as observed by him for more than ten years in England, and shows that they demonstrate a systematic difference from the lower currents, which latter obey the so-called Buys-Ballot law, and that, in general—

In whatever position we stand relatively to the centers of highest or lowest pressures, we find the motions of the upper current more commonly inclining from the lower toward the higher pressures than in the contrary direction.

Or, again:

The number of instances in which the upper currents incline from low to high pressures and that in which they incline from high to low pressures is about as four to one.

Or, again, page 156:

The higher currents of the atmosphere, while moving commonly in a general way with the highest pressures on the right of their course, yet manifest a distinct centripetal tendency over the areas of high pressure and a distinct centrifugal tendency over the areas of low pressure. This tendency is the more noticeable as being the contrary of that which prevails in the motion of the surface winds. The latter, when deviating from a parallelism with the isobarics, incline, in a large percentage of examples, toward lower and from higher pressures.

About 1881 the Editor discovered that in 1846 the distinguished J. Allan Broun had anticipated all more recent work by his own publications on this subject and Broun's law must be recognized as an addition to meteorological science whose importance we have only lately realized.

The results of meteorological and magnetic observations at the observatory of General Sir Thomas M. Brisbane at Makerstoun, in Scotland, are published as Volumes XVII (1845), XVIII (1848), and XIX (1849). These observations and discussions are almost wholly due to J. Allan Broun. In Vol. XVII, page 300 of the record for 1843, Vol. XVIII, pages 439–441, for the discussion of the observations of 1844, and in Vol. XIX, Part II, pages 102–104 of the general discussion of the results for the whole four years, 1843–46, Broun gives a continuous series of harmonious tables discussing several thousand observations on each particular kind

of cloud according to Howard's nomenclature. His classification by quadrants shows that the same law holds good for all directions as well as for all kinds of clouds, viz, for all altitudes. Combining the four quadrants, his figures show that the lower scud is inclined outward to the wind by 14.5°, the cirro-stratus current is inclined 22.8°, and the current of the true cirri is inclined outward 29.6°. Having, from his wind observations, found that the average or resultant direction of the surface wind at Makerstoun is from the point west 21° south, it follows that, in general, the resultant scud is from west 7° south, the cirro-stratus from the west 2° north, and the cirrus proper from west 9° north. Broun includes cumulus with scud.

The law deduced by Broun for Makerstoun, i. e., that the upper currents are deflected to the right of the lower, has a general application to the whole Northern Hemisphere.

SEASONAL FORECASTS IN INDIA AND AMERICA.

During the past fourteen years the meteorological office at Calcutta has regularly published in May or June a memorandum giving all the accessible data relative to recent snowfall, rainfall, pressure, temperature, and wind that seemed in any way to bear upon the possibility of forecasting the probable character of the approaching southwest monsoon winds and rains. Such seasonal forecasts can undoubtedly be utilized by many classes of citizens, and the extent to which they are so used must depend largely upon the accuracy with which the season can be forecast.

The memorandum and monsoon forecast for 1898 was published on June 3 of this year by Mr. John Eliot, Meteorological Reporter to the Government of India.

The following is a summary of the chief features of the meteorology of India during the past six months, which are most likely to influence the advance of the monsoon currents and the distribution of the monsoon rainfall:

1. The snowfall of the past winter has undoubtedly been much less than usual over the whole of the western Himalayas and probably also in Afghanistan. It was probably in local excess in Chitral and perhaps in Baluchistan, due chiefly in the latter area to heavy precipitation in December and March. There was a heavy and somewhat abnormal fall in the second week of May over the whole of the western Himalayas (as was also the case in 1883, 1884, and 1888).

2. The pressure conditions in India during the past five months were such as accompany higher temperature in northern India and less snowfall than usual in the western Himalayas, and probably also the eastern Himalayas. The chief features, which have been remarkably persistent, are (*a*) general deficiency of pressure, (*b*) local deficiency in northern India and Burma, most marked in Bengal and Burma, and (*c*) local excess in western India, greatest in Sind, Kathiawar, and the Konkan.

3. The temperature conditions during the past five months are such as usually accompany a more open and drier winter than usual (with scanty snow) in the Himalayan area. Temperature was largely in excess in April and in moderate excess in May. The excess in these months was, on the whole, most pronounced in northwestern India and the north Deccan.

4. The air has been throughout nearly the whole season much drier than usual and skies remarkably free from cloud.

5. The air movement was more vigorous than usual in March and April, due to the intensified thermal conditions of the period in the interior of India.

6. Hence, the snowfall in the Himalayan area has been of such a character as not to impress any conditions upon the pressure distribution, temperature, and air movement in northern and central India unfavorable to the early or full extension of the monsoon currents in their progress northward from the equator.

It may be noted that some of the abnormal features of the meteorology of India during the past seven months have been related to abnormal conditions prevailing in Persia and southeastern Europe. Anticyclonic conditions obtained to a most unusual degree in southern Europe from November onward, and, as a consequence, cool, dry, northwest winds prevailed in Persia with remarkable persistence from November to February. This abnormal air movement extended across Baluchistan and the north of the Arabian Sea into northwestern India, and has undoubtedly contributed to the unusual dryness of the air and freedom from cold-weather storms of the period in northern and central India.

After discussing the special features of the weather and monsoons since 1879, Mr. Eliot makes a detailed forecast for the southwest monsoon and rains of 1898, as follows:

The southwest monsoon rains will probably commence not later than the end of the first week of June on the coast of Bombay and the third week of June on the coast of Bengal. As to the quantity of rainfall, the general conclusion is that the rainfall may be deficient to a slight or moderate extent, depending chiefly upon the strength of the monsoon in Sind, Cutch, the north and west Punjaub, and west Rajputana; that it will very probably be at least normal in amount in central India and the northern half of the Peninsula, except, perhaps, Berar, Khandesh, and the west Deccan, and may be in moderate excess in the eastern half of the northwestern provinces, Bihar, the central provinces, and the eastern states of central India. It will probably be normal or in excess in Burma, Assam, and perhaps in east and north Bengal, and may be in slight defect in west Bengal.

In nearly all parts of the world the rainfall goes hand in hand with the distribution of pressure and wind, and, in fact, follows after these. It would not be surprising, therefore, if we should eventually be able to do for portions of the United States as well as Blanford and Eliot have done for India.

EARTHQUAKES IN NEW BRUNSWICK.

Mr. Samuel W. Kain has published in the bulletin of the Natural History Society of New Brunswick a list of all the earthquakes on record in that Province, together with such details of each as seem worthy of preservation. The following list of dates is taken from his work:

The times given by him are those of St. John local time, which may be reduced to seventy-fifth meridian time by subtracting 35′ 44″.

1663, February 5, 5:30 p. m. to 8 p. m.
1755, November, on several dates.
1764, September 30, about noon.
1817, May 22, 3:31 a. m.
1824, July 9.
1855, February 8, 6:30 a. m.
1860, October 17, 6:25 a. m.
1869, October 22, 5:48 a. m.
1870, March 17, 6 to 8 a. m.
1870, October 20, 11:40 a. m.
1882, December 31, 9:56 p. m.
1884, January 26.
1885, June 10, 10 a. m.
1896, March 22, 7:56 p. m.
1896, May 15, 11 p. m.
1897, January 26, a. m.
1897, January 28, 9 p. m.
1897, February 14, 9 p. m.
1897, September 25, 1:30 p. m.
1897, October 12, 10:35 p. m.
1898, January 11, 2 a. m.

Concerning each of these Mr. Kain gives such other details as are accessible to him, and will, of course, be pleased to hear from those who can add to the list. He notes the great frequency of earthquakes at Grand Manan, and that shocks are of frequent occurrence in the Bay of Fundy, where they are generally spoken of as the reports of cannon. In regard to this point, Dr. George F. Matthew said:

This part of the Bay of Fundy is remarkable for its great depth and precipitous shores. Off Brier Island the bottom descends to a depth of 100 fathoms in a distance of three miles from the outermost ledge; it is almost equally abrupt on the Grand Manan slope; the trough between is deeper than the bottom of the Gulf of Maine outside adjoining. This is the only part of the Bay of Fundy where there have been heavy outflows of trap of Triassic age on *both* sides of the bay, and the abyss between may be complementary to these ejections of lava. The weakness of the earth's crust here in Triassic times, as shown by the volcanic eruptions of that age, may not even yet be altogether removed; but the greater tendency to earthquake movements in this district may be the dying throes of the old Triassic disturbances.

RECENT EARTHQUAKES.

Prof. E. W. Morley, at Cleveland, Ohio, and Prof. C. F. Marvin, at Washington, D. C., report no disturbance on their seismoscopes during the month of June. The following ad-

ditional notes have been received, giving the dates and locations of slight shocks:

June 3.—*Washington*, Lakeside, slight, time not given.
6th.—*Kentucky*, Richmond, 2:30 a. m.
8th.—*California*, Ukiah.
9th.—*California*, Upperlake, 12:45 p. m.; Ukiah.
11th.—*Vermont*, Vernon, 1:45 a. m.; jarred the house. *California*, Ukiah.
14th.—*Alabama*, Riverton, slight. *Arkansas*, Corning, 9:20 a. m.; Osceola, 9:28 a. m. *Kentucky*, Blandville, Owensboro, and Union City, at about 9:15 a. m. *Missouri*, New Madrid, 9:20 a. m., several seconds' duration; Gordonville, 9:25 a. m. *Tennessee*, Bolivar, Wildersville, and Savannah, 9:30 a. m.; Memphis, 9:25 a. m., lasting two minutes. *Indiana*, Evansville, 9:30 a. m.
23d.—*California*, Descanso, 1:44 p. m.
24th.—*California*, Descanso, 2:45 p. m.
26th.—*Kentucky*, Richmond, 2:30 a. m.
30th.—*California*, Los Angeles, 11:28 p. m., shock from southwest to northeast of about two seconds' duration. The shock seems to have been of a local character. Articles were thrown about, and a rumbling noise was heard. No reports of a quake from any neighboring city were received, notwithstanding numerous inquiries.

MATHEMATICS AND METEOROLOGY.

A student asks that a brief course of mathematics be laid out for him which will fit him to teach meteorology to ordinary college classes. He does not himself wish to go into extended research work in mathematical meteorology, but he wants to get enough mathematics to give him an understanding of meteorological text-books and articles. His present preparation is that ordinarily pursued for entrance into the freshman class, namely algebra, plane geometry, and plane trigonometry.

Assuming that the applicant wishes to teach the correct theory or explanation of meteorological apparatus, such as is given in the "Treatise on Meteorological Apparatus and Methods," published in the Report of the Chief Signal Officer for 1887, and that he also wishes to thoroughly understand, if not teach, the thermodynamics implied in such text-books as those of Ferrel, Davis, and Waldo, and which forms the vital part of dynamic meteorology, and that he, furthermore, wishes to fortify himself as to fundamental principles which should guide one in the study of statistical climatology, it is probable that his wisest course is to spend at least two years more in the study of pure mathematics, and, also, two years in practical work in the laboratory on experimental and theoretical physics. Assuming that his lectures and text-books must be in the English language, we can in the following lines refer only to a limited number of works in that language, but, if any way possible, the student should be careful to select as his teacher or adviser one who is familiar with what is published in other languages.

The first step must be to conquer solid geometry, spherical trigonometry, and analytical geometry, to which end one may take almost any one of the serial school text-books, such as those of Bowser, Chauvenet, Loomis, Newcomb, Todhunter, Wells, Wentworth, or Williamson.

Next to these analytical treatises graphics must claim his attention, viz, perspective, descriptive geometry, the projections of the sphere, as applications of these are continually occurring in meteorological work.

The mechanics of masses, whether solid, liquid, or gases, is, of course, fundamentally important, and before attacking the more difficult treatises it is advisable to study some elementary work, such as Smith's Elementary Mechanics, which was first prepared in 1849 for the students at Wesleyan but was subsequently taught to the students of the Naval Academy at Annapolis. In connection with this, read the Elementary Mechanics of Oliver J. Lodge and, also, Clerk Maxwell's little manual, Matter and Motion.

As some knowledge of the whole range of physics is essential, the student may take up for elementary home reading the admirable Everett's Translation of Deschanel, and will also profit as to more recent discoveries by reading Barker's Physics in that connection. The first part of Deschanel has to do with mechanics and should be read in connection with works previously mentioned. The chapter of Deschanel on heat should also be read in connection with the special treatises of Maxwell, Stewart, Tillman, or Tait in order that the student may get the elements of thermodynamics clearly before his mind.

The preceding will prepare one for nearly all that is necessary in order to understand my Treatise on Meteorological Apparatus and Methods, most of which, in fact, the student should have read as he progressed in the study of physics.

As a guide to reasoning upon statistical climatological data, some treatise on probability, such as Merriman's Least Squares, may now be read, after which the student will proceed with ease through the Short Memoirs, translated in the Smithsonian Report for 1877.

The student should now prepare himself to study and appreciate thermodynamics and hydrodynamics. He will, already, have learned something about these from the works on physics above mentioned, but he will not make satisfactory progress in reading recent works in which these are applied to meteorology without first mastering the elements of the Calculus, for which study there are several excellent treatises, such as those of Bowser, Byerly, Courtenay, Todhunter, Williamson, to which should be added some treatise on differential equations, such as that of Boole or Johnson, and some treatise on the potential function, such as that of B. O. Peirce. From these he may proceed to such works as Bartlett's Analytical Mechanics, Tait's Thermo-Dynamics, and Lamb's Hydrodynamics. Selected portions of the latter work may be chosen for their special bearing on atmospheric motion, and as preliminary to reading the translations of memoirs on the Mechanics of the Earth's Atmosphere, published by the Smithsonian Institution in 1893.

This seems a rather long journey before entering the realm of current literature in dynamic meteorology, but these are the royal gates through which one would prefer to pass in order that he may fully appreciate the present and future of our science. The path would be shortened if one or two special treatises were available for this purpose, or if one could read with another who had previously gone over the whole ground. In fact, much of this was condensed by Ferrel into one volume, viz, his Recent Advances, published in 1885, which is very convenient for reference, but is thought to be too difficult to commend to the young student.

METEOROLOGY BY CORRESPONDENCE.

The so-called system of university extension in which it is sought to bring to the very doors of the homes of distant students many of the privileges enjoyed by those who study in person within the halls of the great universities is generally considered as applicable, especially to the study of philosophy, languages, and history, but not with great success to the physical sciences, since any advanced course in the latter demands an extensive laboratory apparatus. Among the sciences, descriptive botany, mathematical astronomy, mechanics, and pure mathematics have been included in the university extension work, but meteorology among others has been omitted, as far as we are aware. Now our experience assures us that there really is a widespread popular desire to come to a

better understanding of the processes going on within the atmosphere, and it is evidently the duty of the Weather Bureau to foster and respond to such desires to the best of its ability. The study of meteorology is just beginning to be considered as a course proper for high schools and colleges, but the difficulty is everywhere felt that properly educated teachers are not available. Under these circumstances the best that can be done consists in entrusting the teaching of both elementary and advanced meteorology to those whose training in experimental and mathematical physics has fitted them to appreciate the minor points, and conquer the major difficulties of the subject. As to those who can not attend academies and colleges, including many of the regular and voluntary observers of the Weather Bureau, the best course for them will be to pursue systematically either a general course of home study or a special course adapted to their individual difficulties. To both the young instructor and the older observers it may be appropriate to state that the Chief of the Weather Bureau is in hearty sympathy with them in both their desires and their difficulties, and hopes that if in any way the Editor can, by correspondence, be useful to them, they will freely address themselves to him.

When the "Laboratory Manual of Elementary Meteorology," promised by Mr. R. DeC. Ward, has been published, we shall, undoubtedly, have a book that will largely replace the correspondence method of study.

METEOROLOGICAL TABLES AND CHARTS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table IV gives, for 26 stations selected out of 113 that maintain continuous records, the mean hourly temperatures deduced from the Richard thermographs described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table V gives, for 26 stations selected out of 104 that maintain continuous records, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table VI gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table VIII gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table IX gives, for about 70 stations, the average hourly sunshine (in percentages) as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table X gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XI gives the record of excessive precipitation at all stations from which reports are received.

NOTES EXPLANATORY OF THE CHARTS.

Chart I.—Tracks of centers of high pressure. The roman letters show number and order of centers of high areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the highest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a ridge of high pressure.

Chart II.—Tracks of centers of low pressure. The roman letters show number and order of centers of low areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the lowest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a trough or long oval area of low pressure.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level isobars and isotherms, and resultant winds. The wind directions on this Chart are the computed resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and are reduced to sea level and to standard gravity. The reduction for 30 inches of the mercurial barometer, as formerly shown by the marginal figures for each degree of latitude, has already been applied.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Surface temperatures; maximum, minimum, and mean. Lines of equal monthly mean temperature in red; lines of equal maximum temperatures (broken) in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

TABLE I.—*Climatological data for Weather Bureau Stations, June, 1898.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.																															
Eastport		76	69	74	29.86	29.95	+ .02	62.0	— 1.2											1.47	— 1.4										
Portland, Me		103	81	89	29.83	29.92	— .01	54.3	— 0.8											3.09	— 0.4	13	6,145	s.	32	ne.	4	5	11	14	5.9	
Northfield		872	15	65	29.04	29.96	+ .03	61.3	— 2.0	89										3.98	+ 0.6	15	4,984	s.		sw.		5	11	14	7.9	
Boston		135	115	181	29.84	29.98	+ .02	62.4	— 1.2	86	8	74								2.28	— 1.2	14	5,484	s.	24	s.	13	4	11	15	6.6	
Nantucket		14	43	54	29.97	29.98	— .02	65.8	— 0.5	92	8	74								1.60	— 1.5	10	7,772	sw.	30	ne.	3	10	9	11	6.0	
Woods Hole		22	51	57				59.6	— 1.6	76	26	65								0.63	— 2.2	8	8,090	sw.	36	ne.	1	5	11	14	6.9	
Vineyard Haven			30					61.0	— 1.4	80	26	66								1.10	— 1.4	7	9,821	sw.	40	s.	25	16	9	5	4.3	
Block Island		27	39	48	29.97	30.00	+ .01	64.1	— 1.9	84	26	71								0.81	— 1.4	10		sw.				14	9	7		
Narragansett			10					60.6	— 1.4	78	13	66								0.92	— 1.7	11	9,635	sw.	50	ne.	4	11	14	5	4.7	
New Haven		107	118	140	29.87	29.98	— .01	64.0	— 0.6	95	26	71								0.10	— 2.5	5		w.				20	3	7		
Mid. Atlan. States.								66.9	— 0.4	90	26	76								0.21	— 2.7	6	6,757	s.	38	ne.	4	7	18	5	5.3	
Albany		97	84	113	29.88	29.99	+ .04	71.0	+ 0.1											2.47	— 1.2									4.7	
Binghamton		875	79	90				69.9	+ 0.9	95	25	80								5.58	+ 1.9	12	4,694	s.	34	s.	18	8	17	5	5.4	
New York		314	298	326	29.67	30.00	+ .01	66.8	+ 0.5	89	25	78								2.16	— 1.2	10	3,941	w.	25	w.	25	5	16	9	6.0	
Harrisburg		377	94	104				68.9	— 0.1	89	25	76								1.28	— 1.8	9	7,857	sw.	40	sw.	25	10	16	4	4.6	
Philadelphia		117	168	184	29.89	30.01	+ .01	72.0	+ 1.5	95	25	82								1.98	— 2.3	9	4,489	w.	34	w.	25	10	12	8	5.0	
Atlantic City		52	68	76	29.96	30.01	+ .02	72.4	+ 0.7	94	26	82								1.75	— 1.4	9	6,833	sw.	36	nw.	26	10	12	8	5.3	
Cape May		24	52	70	30.01	30.03		66.6	— 0.2	92	26	73								2.49	— 0.7	10	7,574	sw.	38	ne.	4	13	14	3	4.4	
Baltimore		123	68	92	29.88	30.01	+ .01	67.6	— 0.6	88	26	72								2.02		11	8,005	sw.	32	s.	21	15	9	6	4.3	
Washington		112	59	76	29.90	30.02	+ .01	73.8	+ 0.3	98	25	83								1.06	— 3.0	6	3,754	sw.	22	n.	25	5	16	9	6.0	
Cape Henry			5	34				73.5	+ 0.3	97	25	84								1.33	— 2.7	5	4,062	s.	30	nw.	19	11	17	2	4.3	
Lynchburg		685	83	88	29.32	30.03	+ .01	72.6	— 0.5	102	26	80								2.83	— 1.1	15		ne.			28	15	13	2	3.8	
Norfolk		57	88	93	29.98	30.04	+ .02	73.9	— 0.3	94	12	84								2.98	— 0.5	11	2,610	sw.	24	nw.	13	12	11	7	3.6	
Richmond		144	98	105				74.0	— 1.1	96	27	82								3.76	— 0.5	8	5,496	sw.	36	sw.	28	15	9	6	4.7	
S. Atlantic States.								74.8		97	26	85								2.98		12	4,364	n.	28	w.	26	9	14	7	4.8	
Charlotte		773	68	76	29.23	30.02	— .01	77.7	+ 0.5											3.82	— 1.8									4.0	
Hatteras		11	17	36	30.03	30.04	+ .01	77.4	+ 1.6	97	9	88								3.79	— 0.8	12	4,485	e.	36	nw.	26	19	8	3	5.0	
Kittyhawk		9	12	30				72.2	— 1.8	84	25	78								3.27	— 1.3	8	9,689	s.	42	n.	5	16	6	8	4.1	
Raleigh		375	93	101	29.65	30.04	+ .01	71.2	— 3.0	95	26	78								4.85	+ 0.2	11	10,619					16	5	9	4.5	
Wilmington		78	82	90	29.98	30.06	+ .03	76.0	+ 0.3	97	26	86								3.28	— 2.2	10	4,308	sw.	36	sw.	10	15	11	4	4.1	
Charleston		48	14	92	30.05	30.10	+ .06	77.0	+ 0.3	94	26	86								4.59	— 1.1	10	5,835	sw.	28	ne.	15	11	15	4	4.3	
Columbia			5					80.0	+ 0.9	94	26	86								4.68	— 1.0	10	7,458	s.	35	w.	19	13	17	0	3.5	
Augusta		180	89	101	29.85	30.04	+ .03	80.4	+ 2.3	99	14	93								3.12	— 1.0	9		sw.				13	11	6		
Savannah		82	63	89	29.79	30.07	+ .03	80.6	+ 1.8	97	30	91								4.58	— 2.0	11	4,117	ne.	36	nw.	19	14	15	1	3.5	
Jacksonville		43	69	84	30.03	30.08	+ .04	80.4	+ 1.1	97	12	90								2.13	— 3.3	8	5,399	s.	28	w.	18	15	14	1	3.9	
Florida Peninsula.								81.4	+ 1.3	96	17	91								2.84	— 3.2	8	5,462	sw.	36	sw.	17	14	16	0	4.4	
Jupiter		28	13	30	30.06	30.09	+ .04	83.0	+ 0.4											0.12	— 6.5	3	6,050	se.		se.	19	18	11	1	3.1	
Key West		22	43	50	30.05	30.07	+ .03	79.4	+ 0.4	89	20	86								2.44	— 1.6	8	6,107	se.	25	sw.	10	20	9	1	3.5	
Tampa		36	60	67	30.04	30.08	+ .04	82.5	0.0	89	20	87								5.96	— 1.6	15	4,130	se.	26	se.	27	17	13	0	3.0	
East Gulf States.								80.8	+ 0.8	95	28	91								0.89	— 2.0									5.0	
Atlanta		1,131	92	126	28.89	30.04	— .01	80.6	+ 1.5											2.88	— 2.5	8	5,497	sw.	30	sw.	12	11	16	3	4.3	
Pensacola		56	78	90	30.00	30.06	+ .03	79.2	+ 3.5	95	10	80	65	20	69	37	69	64		4.86	— 1.0	12	4,800	sw.	44	nw.	18	6	18	6	5.6	
Mobile		57	88	96	30.00	30.06	+ .04	81.0	+ 1.6	91	30	86	69	18	75	18	75	72		1.41	— 3.3	8	4,531	sw.	38	nw.	5	15	13	2	3.7	
Montgomery		221	100	112	29.80	30.01	.00	80.2	+ 0.5	93	30	87	70	18	73	21	74	72		6.17	+ 1.9	15	3,867	se.	30	sw.	13	10	18	2	4.6	
Vicksburg		247	65	73	29.76	30.02	.00	81.7	+ 2.3	98	1	92	67	22	72	28	71	66		3.79	— 2.8	11	4,774	se.	34	se.	27	2	22	6	5.6	
New Orleans		54	112	120	29.99	30.05	+ .05	79.5	+ 0.3	93	22	88	68	16	71	24	73	72		1.07	— 3.1	5		s.				0	26	4		
Port Eads			27					81.1	+ 0.8	91	6	88	70	20	74	19	73	71		4.69	+ 0.9									5.7	
West Gulf States.								81.5	+ 1.6	90	17	87	73	12	76	13				7.25	+ 3.5	16	4,175	se.	31	se.	4	6	14	10	6.0	
Shreveport		249	77	84	29.73	29.99	.00	75.7	— 0.7											5.64	+ 1.3	17	3,844	e.	34	e.	3	7	10	13	6.2	
Fort Smith		481	63	72	29.46	29.95	.00	79.9	0.0	95	1	90	67	17	70	25	72	70		3.03	— 1.3	12	4,084	s.	40	s.	12	0	21	9	6.7	
Little Rock		302	71	79	29.69	30.00	+ .02	78.8	+ 2.7	98	21	88	65	5	70	22	71	69		2.44	— 0.2	7	9,779	se.	34	se.	26	17	9	4	3.7	
Corpus Christi		20	42	50	29.94	29.96	— .02	79.4	+ 2.4	93	1	88	64	1	71	29	72	69		1.94	— 2.9	12	6,636	s.	32	nw.	12	7	19	4	4.8	
Galveston		42	85	96	29.95	29.99	.00	80.1	— 0.2	88	19	84	64	10	76	18	77	76		5.50	+ 1.2	18	4,102	s.	28	s.	9	1	10	19	7.4	
Palestine		510	54	61	29.45	29.98	— .01	81.0	— 0.6	89	19	85	71	30	77	15	75	73		7.06	+ 4.4	14	6,143	se.	66	nw.	11	12	10	8	5.0	
San Antonio		704	95	104	29.22	29.94	— .01	78.6	+ 0.4	93	23	88	64	1	70	23	73	72		3.83	— 0.4									4.1	
Ohio Val. & Tenn.								80.4	— 0.3	95	4	90	64	10	71	26	72	69		3.47	— 0.6	10	4,840	ne.	36	n.	19	22	8	0	1.8	
Chattanooga		762	106	112	29.26	30.04	.00	75.9	+ 1.9											2.76	— 1.9	12	5,575	sw.	52	w.	12	10	13	7	5.1	
Knoxville		1,004	10	88	29.00	30.03	.00	78.1	+ 2.9	97	9	89	59	23	68	31	68	63		4.97	+ 0.7	11	4,093	sw.	29	s.	12	13	16	1	3.8	
Memphis			399	140	154	29.59	30.00	+ .01	77.1	+ 3.5	99	10	89	57	23	66	31	67	63		7.94	+ 3.7	10	6,011	e.	46	sw.	25	10	14	6	5.3	
Nashville			545	128	134	29.45	30.01	+ .02	79.6	+ 1.5	92	24	88	65	12	71	33	72	70		5.00	+ 0.7	7	5,070	sw.	45	s.	10	14	12	4	4.5	
Lexington			989	75	104	28.98	30.00	+ .02	78.7	+ 2.1	95	10	89	61	1	68	30	69	64		1.71		10	4,678	ne.	29	sw.	26	20	7	3	2.7	
Louisville			525	114	136	29.45	30.01	— .02	74.4	+ 0.6	93	10	84	57	30	65	26	66	62		1.77	— 2.9	9	6,254	ne.	36	sw.	25	9	16	5	5.0	
Evansville			434	72	82				77.4	+ 2.3	94	9	88	58	1	67	30	67	62		1.58	— 2.8	11	4,551	sw.	45	w.	25	10	16	2	3.5	
Indianapolis			823	154	164	29.15	30.00	+ .01	78.2											1.63	— 1.9	6	4,749	sw.	28	w.	25	12	12	2	3.7	
Cincinnati			628	152	157	29.36	30.02	+ .03	73.6	+ 1.1	91	30	84	54	22	64	27	65	60		3.98	+ 0.5	10	4,092	n.	48	nw.	25	7	21	2	5.2	
Columbus			824	87	100	29.14	30.00	+ .02	75.5	+ 1.7	92	24	85	56	22	66	27	65	59		4.98	+ 0.8	12	3,406	s.	52	nw.	25	14	12	4	4.3	
Pittsburg			842	116	123	29.13	30.00	+ .01	73.8	+ 2.5	95	30	84	51	22	63	31	65	61		2.73	— 0.9									4.8	
Parkersburg			638	77	84	29.36	30.03	+ .01	73.8	+ 2.2	92	11	83	55	23	64	28	65	60		2.14	— 1.4	10	9,502	sw.	47	sw.	25	4	20	6	5.6	
Lower Lake Region.								73.0	+ 0.3	94	10	84	48	22	62	34	65	61		1.12	— 2.3	11	5,982	w.	31	n.	15	10	11	9	5.2	
Buffalo			768	178	206	29.16	29.95	— .01	68.5	+ 1.4										0.89	— 2.3	9	5,791	sw.	29	sw.	26	11	9	10	5.4	
Oswego			335	76	87	29.60	29.96	.00	67.2	+ 2.2	82	1	74	47	16	60	25	62	59		2.87	— 1.1	11	6,415	w.	28	w.	26	13	15	2	4.6	
Rochester			523	81	90	29.42	29.97	+ .01	65.4	+ 1.4	88	30	72	46	16	58	27	60	56		2.74	— 1.2	11	8,543	n.	60	nw.	12	21	9	0	2.4	
Erie			714	92	102	29.25	30.00	+ .04	68.0	+ 1.6	91	30	77	47	23	59	31	61	57		5.11	+ 1.2	11	5,494	sw.	29	nw.	8	9	14	6	6.0	
Cleveland			762	190	201	29.20	29.99	+ .01	67.8	+ 0.8	86	24	75	50	16	61	27	62	58		1.79	— 1.6	7	3,726	sw.	26	sw.	11	9	16	7	5.2	
Sandusky			629	62	74	29.33	29.99	+ .01	68.8	+ 1.0	88	24	76	51	22	62	31	63	60		5.15	+ 1.5	6	6,117	sw.	36	sw.	12	12	12	6	4.4	
Toledo			674	122	127	29.29	29.99	+ .01	70.9	+ 1.9	92	30	80	52	22	62	28	63	58		3.71	0.0									5.5	
Detroit			730	160	166	29.22	29.99	+ .03	70.6	+ 0.8	91	24	80	51	21	61	26	63	58		5.76	+ 2.0	17	6,023	se.	45	sw.	29	9	15	6	5.2	
Upper Lake Region.								69.6	+ 1.7	93	30	79	49	15	60	28	62	58		2.45	— 1.4	9	6,075	sw.	30	sw.	25	8	15	7	5.0	
Alpena			609	61	65	29.31	29.96	+ .02	63.0	— 0.5										3.86	+ 0.4	13	6,401	nw.	38	sw.	24	5	11	14	6.7	
Grand Haven			628	55	64	29.30	29.97	+ .02	62.1	+ 1.8	93	24	71	43	15	53	34	57	55		3.40	— 0.1	10	6,764	n.	52	w.	24	4	11	14	4.2	
Marquette			734	67	95	29.15	29.93	— .01	65.7	+ 1.3	85	7	75	41	21	56	28	60	55		3.07	0.0	12	5,962	w.	45	nw.	1	9	11	10	5.7	
Port Huron			639	70	108	29.32	29.99	+ .03	57.6	— 1.4	90	24	67	40	12	48	26	52	49		5.30	+ 1.5	10	10,985	ne.	50	sw.	24	10	14	6	5.0	
Sault Ste. Marie			624	58	65	29.27	29.94	+ .01	67.0	+ 2.9	92	30	77	45	22	57	30	61	57		2.44	— 1.6	10	6,069	ne.	33	sw.	24	4	11	14	6.5	
Chicago			824	241	274	29.13	29.99	+ .04	57.4	— 2.8	83	24	67	39	15	48	26	54	52		3.60	+ 0.3	11	5,115	n.	30	s.	24	10	11	9	5.2	
Milwaukee			671	106	149	29.27	29.97	+ .01	68.8	+ 2.1	90	29	76	52	21	61	28	62	59		3.52	— 1.1	12	6,428	ne.	32	ne.	2	6	16	8	5.9	
Green Bay			617	49	57	29.30	29.95	.00	66.0	+ 2.7	91	24	75	48	22	57	31	60	56		2.70	— 1.1									5.2	
Duluth			702	95	106	29.18	29.93	+ .01	65.3	— 0.8	88	17	65	38	2	48	26	52	48		2.34	— 2.0	7	7,194	se.	40	se.	28	9	8	13	5.6	
North Dakota.								57.0	— 0.8											1.21	— 2.3	7	7,712	nw.	40	nw.	25	13	10	7	4.7	
Moorhead		935	54	60	28.89	29.88	+ .01	63.2	— 1.4	96	23	74	38	14	53	33	59	55		4.56	+ 1.1	16	6,886	n.	50	w.	28	10	14	6	5.2	
Bismarck		1,674	16	29	28.15	29.88	+ .02	63.4	+ 0.6	95	30	75	40	14	53	34	56	50		3.84	— 0.7									5.2	
Williston		1,875	15	31	27.94	29.89	+ .05	64.4	— 1.6	96	20	72	36	14	52	37	55	49		2.69	— 1.1	11								5.6	
Upper Miss. Valley.								61.7	+ 1.9											2.71	— 1.6	12	5,278	nw.	36	sw.	25	6	17	7	5.5	
Minneapolis			99					73.1	— 0.2	93	23	78	50	11	60	29				2.13	— 2.3	11	4,544	s.	29	sw.	25	11	9	10	5.3	
St. Paul		837	114	124	29.03	29.91	— .01	68.6	— 1.0	93	23	77	49	28	59	31	61	57	70	3.53	— 0.9	10	4,915	sw.	26	sw.	25	9	8	13	5.6	
La Crosse		730	70	78				68.2	+ 1.3	90	24	79	49	2	61	34				6.85	+ 1.5	13	5,641	sw.	36	sw.	10	14	12	4	3.8	
Davenport		599	71	79	29.31	29.94	— .01	70.2	+ 1.9	91	30	82	54	21	64	25	66	62	71												
Des Moines		867	84	88	29.05	29.93	+ .03	72.8	+ 2.1	92	30	81	54	28	63	31	66	62	73												

TABLE I.—*Climatological data for Weather Bureau Stations, June, 1898*—Continued.

Stations.	Elevation of instruments			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometers above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
Up. Miss. Val.—Con																												
Dubuque	698	101	109	29.22	29.95	+ .01	71.1	+ 1.6	90	24	80	52	2	62	30	64	61	73	4.36	− 0.8	14	4,818	se.	28	sw.	25	9	12	9	5.5	
Keokuk	614	64	78	29.32	29.96	+ .02	75.6	+ 3.1	92	30	84	58	20	67	23	68	64	72	4.77	− 0.2	11	4,560	sw.	36	se.	26	15	7	8	4.4	
Cairo	359	87	93	29.61	29.98	+ .01	78.0	+ 2.6	91	24	86	63	30	70	22	72	70	82	1.73	− 2.7	13	4,644	s.	40	w.	12	6	20	4	5.3	
Springfield, Ill.	644	82	92	29.31	29.98	+ .01	74.3	+ 2.1	91	25	83	55	30	65	25	67	63	70	4.76	+ 0.3	11	4,884	sw.	25	s.	9	8	17	5	4.6	
Hannibal	534	75	107	.....	.....	.....	75.3	+ 2.9	91	25	84	55	30	66	27	....	....	....	4.83	+ 0.5	14	5,374	sw.	40	w.	18	15	11	4	3.8	
St. Louis	567	111	210	29.39	29.98	+ .02	77.8	+ 2.6	92	24	86	61	30	70	22	69	66	70	3.85	− 1.2	9	5,514	s.	37	sw.	25	7	15	8	5.4	
Missouri Valley.							72.8	+ 1.8										72	4.60	+ 0.2								4.9	
Columbia	.....	4	84	.....	.....	.....	75.6	+ 1.2	92	25	86	56	30	65	27	....	....	....	9.02	+ 4.5	13	4,422	s.	40	nw.	1	7	16	7	5.6	
Kansas City	963	78	95	28.97	29.96	+ .02	76.0	+ 2.6	93	24	84	63	30	68	22	69	66	77	6.05	+ 1.1	14	5,189	se.	30	nw.	25	8	11	11	5.5	
Springfield, Mo.	1,324	100	103	28.60	29.96	.00	74.0	+ 1.6	87	24	82	60	13	66	23	69	67	80	5.88	+ 1.6	14	5,786	se.	35	sw.	26	2	27	1	5.3	
Topeka	.....	81	.....	.....	.....	.....	75.6	+ 2.4	94	24	85	60	30	66	27	.....	.....	....	2.65	− 2.9	11	.....	s.	.....	.....	...	12	13	5	....	
Lincoln	1,199	74	84	28.66	29.90	− .01	73.5	+ 2.4	95	24	83	53	27	64	29	66	63	73	3.99	− 0.4	10	7,069	s.	34	n.	4	12	12	6	4.7	
Omaha	1,103	92	97	28.78	29.91	.00	73.9	+ 2.4	95	22	82	55	27	65	30	66	62	71	5.16	− 0.5	10	5,478	se.	28	se.	3	15	7	8	4.4	
Sioux City	1,139	96	164	.....	.....	.....	71.0	+ 0.7	95	22	81	51	25	61	37	.....	.....	....	6.61	+ 3.2	13	8,374	se.	66	nw.	24	13	7	10	4.9	
Pierre	1,460	50	62	28.37	29.87	+ .01	70.4	+ 2.2	101	25	82	46	25	58	38	60	54	60	0.77	− 2.6	7	7,244	se.	55	nw.	2	14	13	3	3.9	
Huron	1,306	56	67	28.53	29.90	.00	67.4	+ 0.7	99	28	80	44	25	55	44	60	55	68	1.81	− 1.7	8	7,886	se.	48	s.	2	10	16	4	4.8	
Yankton	1,234	52	58	.....	.....	.....	70.3	+ 1.7	94	22	80	49	25	60	33	....	....	...	4.08	− 0.2	12	6,476	s.	44	s.	2	14	7	9	4.7	
Northern Slope.							62.9	+ 0.1										58	2.24	− 0.4								4.4	
Havre	2,494	46	47	27.29	29.86	.00	61.1	− 0.2	94	19	72	38	2	50	45	52	44	59	1.81	− 1.2	12	7,657	sw.	52	sw.	28	12	13	5	4.4	
Miles City	2,372	41	49	27.42	29.86	+ .01	65.6	− 1.4	102	19	76	45	1	55	34	57	50	67	1.99	− 1.0	9	5,478	n.	40	w.	24	10	13	7	4.8	
Helena	4,106	88	93	25.84	29.98	+ .08	58.5	− 0.9	88	18	69	37	3	48	38	48	39	56	3.52	+ 1.1	14	5,540	sw.	36	sw.	28	13	9	8	4.3	
Rapid City	3,251	46	50	26.58	29.85	− .03	65.6	+ 1.4	95	16	78	43	1	54	45	55	45	52	0.50	− 3.4	7	5,910	w.	30	n.	28	13	10	7	4.6	
Cheyenne	6,105	58	60	24.05	29.88	+ .02	61.2	+ 0.3	91	28	75	34	5	47	40	50	37	50	2.33	+ 0.8	8	6,838	s.	44	sw.	22	15	13	2	3.7	
Lander	5,372	28	36	24.66	29.93	+ .07	59.8	+ 0.7	87	27	74	32	3	45	43	49	38	53	3.02	+ 1.8	10	3,487	w.	40	sw.	19	12	15	3	4.4	15.4
North Platte	2,826	43	52	27.05	29.92	+ .03	68.4	+ 0.5	98	28	79	46	5	58	35	61	57	71	2.54	− 0.9	10	6,552	s.	36	nw.	17	14	12	4	4.5	
Middle Slope.							72.8	+ 1.2										65	2.92	− 0.2								4.0	
Denver	5,290	79	151	24.75	29.90	+ .06	67.0	+ 0.6	98	28	81	41	4	53	39	52	40	48	0.94	− 0.5	8	5,565	s.	41	s.	1	11	15	4	4.4	
Pueblo	4,713	74	81	25.27	29.88	+ .05	68.9	+ 0.6	101	30	83	47	1	55	42	55	44	51	1.34	+ 0.1	10	5,573	nw.	38	nw.	20	15	10	5	4.0	
Concordia	1,398	42	47	28.46	29.89	− .02	75.0	+ 2.7	99	24	85	57	27	65	32	67	63	71	3.65	− 0.8	14	4,867	s.	26	s.	23	11	12	7	4.8	
Dodge	2,504	44	52	27.36	29.88	+ .02	73.5	+ 0.9	96	24	84	53	10	63	30	65	62	72	4.57	+ 1.2	7	8,244	s.	39	s.	30	14	12	4	4.0	
Wichita	1,351	78	85	28.53	29.92	+ .04	75.6	+ 1.7	94	21	86	59	13	66	27	68	65	74	5.24	0.0	13	5,123	s.	36	n.	18	14	11	5	3.9	
Oklahoma	1,218	54	62	28.68	29.93	+ .01	76.8	+ 0.4	93	24	86	62	11	68	23	69	66	76	1.75	− 1.4	9	7,014	s.	36	s.	8	20	9	1	2.8	
Southern Slope.							74.2	− 1.2										68	4.68	+ 1.4								3.8	
Abilene	1,749	45	54	28.16	29.94	+ .02	77.8	− 0.6	98	4	88	61	12	68	34	68	64	70	4.55	+ 1.3	14	6,710	se.	42	ne.	4	11	16	3	4.3	
Amarillo	3,691	54	61	26.25	29.91	+ .01	70.7	− 1.7	93	24	82	53	9	60	33	62	55	65	4.81	+ 1.6	11	10,843	s.	50	n.	26	19	8	3	3.2	
Southern Plateau.							77.6	− 0.8										52	0.41	− 0.1								2.2	
El Paso	3,767	10	110	26.13	29.84	+ .02	76.9	− 3.3	102	26	90	53	10	64	39	59	44	43	0.46	+ 0.1	7	7,187	e.	48	nw.	6	20	9	1	2.7	
Santa Fe	6,998	47	50	23.32	29.90	+ .01	64.2	− 0.9	91	29	76	41	8	53	32	49	32	40	1.53	+ 0.6	8	4,369	sw.	30	se.	18	12	12	6	4.1	
Phœnix	1,076	47	57	28.65	29.74	− .06	84.8	+ 1.0	110	26	100	57	5	69	43	60	40	25	0.08	0.0	2	2,951	w.	28	e.	9	24	5	1	1.8	
Yuma	139	16	50	29.58	29.72	− .06	84.7	− 0.2	112	26	101	58	5	69	44	61	47	34	T.	0.0	0	5,290	s.	34	n.	3	27	1	2	1.0	
Independence	3,907	10	58	25.90	29.74	.....	74.2	.....	99	*	88	38	3	61	35	51	22	17	T.	0.0	0	6,804	nw.	50	w.	1	24	6	0	1.3	
Middle Plateau.							64.3	+ 0.9										42	0.52	− 0.1								3.2	
Carson City	4,730	82	92	25.24	29.91	+ .01	61.6	+ 0.8	88	28	77	32	3	46	39	46	30	37	T.	− 0.4	0	6,329	w.	45	sw.	1	23	7	0	2.1	
Winnemucca	4,340	59	70	25.55	29.88	.00	64.2	+ 1.8	90	27	79	32	3	50	40	53	43	51	0.12	− 0.7	2	7,328	sw.	42	sw.	1	13	11	6	4.2	T.
Salt Lake City	4,344	83	90	25.60	29.89	+ .01	67.1	+ 0.2	96	18	88	33	3	54	35	53	39	39	1.45	+ 0.7	6	4,733	se.	37	nw.	1	18	9	3	3.4	T.
Northern Plateau.							62.4	+ 1.2										53	1.03	− 0.4								4.5	
Baker City	3,470	49	55	26.41	29.94	.00	59.7	+ 3.0	90	18	73	34	3	46	42	48	37	52	0.74	− 0.8	9	3,945	s.	26	nw.	30	10	10	10	5.1	
Idaho Falls	4,742	10	56	25.21	29.91	+ .03	61.0	+ 1.0	91	17	77	32	4	45	47	49	38	53	1.33	+ 0.2	7	7,680	s.	46	sw.	24	14	4	12	4.7	
Spokane	1,943	99	107	27.92	29.93	+ .01	63.0	+ 0.6	90	18	76	41	2	50	36	51	39	50	1.21	− 0.5	8	5,003	sw.	36	sw.	27	13	10	7	4.5	
Walla Walla	1,018	65	73	28.88	29.95	+ .02	66.0	+ 0.4	95	10	78	43	1	54	36	56	48	58	0.84	− 0.6	5	4,015	s.	28	w.	29	17	12	1	3.8	
N. Pac. Coast Reg.							58.8	+ 1.4										74	2.57	+ 0.3								5.4	
Fort Canby	179	10	34	29.82	30.01	+ .01	57.2	+ 1.7	85	5	62	45	1	52	37	54	53	89	3.35	+ 0.7	15	8,768	n.	56	se.	15	7	6	17	6.8	
Port Angeles	29	47	62	.....	.....	.....	55.0	+ 1.3	74	8	62	42	4	48	28	....	....	....	1.24	− 0.1	10	4,177	nw.	24	nw.	24	9	10	11	5.3	
Pysht	.....	5	.....	.....	.....	.....	57.6	+ 1.4	81	5	67	42	4	48	33	.....	.....	....	2.65	0.0	14	.....	w.	.....	.....	...	*12	*1	*16	....	
Seattle	119	114	121	29.88	30.01	− .01	61.4	+ 2.0	88	6	70	46	2	52	33	54	49	68	2.13	+ 0.9	11	3,620	s.	20	sw.	27	12	11	7	4.8	
Tacoma	213	113	120	.....	.....	.....	60.3	+ 2.1	88	6	70	46	1	51	34	.....	.....	....	2.41	+ 0.6	11	4,005	n.	23	sw.	24	14	3	13	5.0	
Tatoosh Island	86	7	21	29.93	30.03	+ .03	54.6	+ 1.1	70	6	59	46	2	50	13	52	49	80	5.78	+ 1.7	18	7,321	sw.	38	s.	15	6	5	19	7.2	
Astoria	.....	18	.....	.....	.....	.....	59.3	+ 1.7	90	6	67	40	1	52	33	.....	.....	....	2.66	− 0.4	15	.....	s.	...	.....	...	6	9	15	....	
Portland, Oreg	158	203	213	29.83	29.99*	− .06	62.5	+ 0.9	90	6	71	43	2	54	30	54	47	64	1.88	0.0	10	5,920	nw.	33	sw.	15	16	12	2	3.4	
Roseburg	521	56	67	29.42	29.98	− .08	61.7	+ 0.7	89	5	74	39	3	50	39	54	48	67	1.04	− 0.3	9	2,846	nw.	20	sw.	15	12	6	12	5.3	
Mid. Pac. C'st Reg.							62.9	+ 1.1										64	0.42	− 0.1								3.6	
Eureka	64	60	69	29.95	30.01	− .03	56.3	+ 1.6	75	17	61	45	28	52	27	52	50	81	1.21	− 0.1	9	6,254	nw.	38	nw.	30	11	6	13	5.6	
Red Bluff	334	54	58	29.52	29.86	− .03	75.4	+ 0.8	102	28	89	44	1	62	36	58	44	40	0.14	− 0.4	2	5,382	se.	36	nw.	30	21	6	3	2.4	
Sacramento	71	106	117	29.80	29.87	− .04	69.6	+ 1.0	99	28	84	47	2	55	42	57	48	55	0.14	0.0	1	7,651	sw.	36	n.	30	24	5	1	2.5	
San Francisco	153	161	167	29.79	29.95	− .01	59.0	+ 0.6	89	4	66	49	23	52	35	54	50	80	0.19	0.0	2	9,426	sw.	40	w.	6	18	9	3	3.7	
Point Reyes Light	.....	12	....	.....	.....	.....	54.4	+ 1.4	85	4	60	45	29	49	34	...	...	....	0.42	0.0	3	.....	nw.	.....	.....	...	18	5	7	....	
S. Pac. Coast Reg.							67.9	+ 1.3										63	0.02	− 0.1								2.6	
Fresno	332	67	70	29.47	29.81	− .07	77.2	+ 3.2	107	25	94	51	3	60	41	57	40	33	0.00	− 0.1	0	5,293	nw.	22	nw.	14	27	3	0	1.2	
Los Angeles	330	74	82	29.53	29.88	− .06	67.1	+ 1.4	95	4	78	50	1	56	42	58	54	76	T.	− 0.1	0	3,128	w.	15	w.	2	6	22	2	3.9	
San Diego	87	94	102	29.79	29.89	− .06	63.8	− 0.3	88	4	68	54	4	59	34	58	56	80	0.02	0.0	1	4,133	sw.	18	nw.	1	23	3	4	2.8	
San Luis Obispo	201	10	46	29.72	29.94	− .02	63.4	+ 1.0	98	5	77	44	23	50	45	54	47	64	0.04	− 0.1	2	3,773	w.	24	n.	2	21	8	1	2.5	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. *Two or more dates. †Received too late to be considered in departures, etc.

TABLE II.—*Meteorological record of voluntary and other cooperating observers, June, 1898.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco †	98	64	79.3	5.31	
Ashville †	100	57	80.2	2.97	
Bermuda †	98	63	80.2	3.37	
Birmingham †	98	63	81.0	4.35	
Bridgeport †	.....	.....	.....	2.33	
Citronelle †	94	70	80.8	4.16	
Clanton †	96	63	79.9	2.05	
Daphne	94	67	81.6	4.43	
Decatur †	103	57	79.8	1.65	
Demopolis	.....	.....	.....	6.72	
Elba	95	60	79.2	5.84	
Eufaula *a* †	100	66	82.4	2.08	
Evergreen	94	67	78.7	7.99	
Florence *a* †	.....	.....	.....	2.30	
Florence *b* †	95	61	79.5	2.01	
Fort Deposit	97	65	81.8	5.80	
Gadsden	99	58	79.8	1.16	
Goodwater	99	60	81.0	4.92	
Greensboro †	95	68	80.8	5.97	
Hamilton	100[3]	61	80.0[4]	2.26	
Healing Springs	96	62	78.8	5.53	
Highland Home †	93	68	80.0	5.09	
Livingston	99	68	83.1	5.74	
Lock No. 4	100	61	79.8	5.27	
Madison Station †	100	55	78.2	0.93	
Maplegrove	100	60	79.0	4.52	
Marion †	102	60	82.0	4.00	
Mount Willing †	98	60	81.3	4.20	
Newbern †	96	70	82.2	4.09	
Newburg	101	56	80.8	1.26	
Newton †	95	61	79.2	3.46	
Oneonta	96	56	77.4	3.59	
Opelika †	98	63	82.0	1.26	
Oxanna †	95	59	76.8	2.88	
Pineapple	100	65	82.4	4.45	
Pushmataha †	98	66	82.3	3.60	
Riverton †	98	59	79.8	1.06	
Rockmills	100[3]	64[1]	78.0[4]	1.76	
Scottsboro †	98	56	77.2	4.68	
Selma †	100	62	82.8	3.59	
Sturdevant	.....	.....	.....	2.71	
Talladega	99	63	80.6	5.10	
Tallassee	.....	.....	.....	3.71	
Thomasville	100	67	82.6	5.81	
Tuscaloosa †	99	62	82.0	4.43	
Union †	98	67[4]	82.6	4.26	
Union Springs †	101	67	83.0	2.87	
Uniontown †	97	71	82.4	3.33	
Valleyhead	99	.....	.....	2.43	
Warrior	.....	.....	.....	2.69	
Wetumpka	99	64	82.0	2.00	
Wilsonville †	.....	.....	.....	3.68	
Arizona.					
Arizona Canal Co. Dam.	109	66	83.8	T.	
Benson *1	103	68	84.1	1.57	
Bisbee †	99	50	75.7	1.91	
Buckeye †	108	52	81.4	0.10	
Camp Creek	102	60	80.0	0.51	
Casa Grande *1	106	70	88.8	0.60	
Champie Camp	111	60	85.8	0.50	
Congress	104	63	83.0	0.29	
Dragoon (Russellville)	.....	.....	.....	0.32	
Dragoon Summit *1	97	49	79.3	0.52	
Dudleyville	108	41	78.0	0.40	
Empire Ranch	100	50	76.0	0.19	
Flagstaff †	96	30	64.2	0.21	
Fort Apache	98	38	70.6	2.60	
Fort Defiance	95	31	63.6	0.74	
Fort Grant †	98	53	75.2	0.37	
Fort Huachuca †	99	50	75.1	0.46	
Gilabend *a* *1	114	76	89.8	0.70	
Holbrook †	101	34	71.0	0.53	
Hot Springs	106	59	82.6	0.68	
Jerome	102	54	77.9	0.70	
Lochiel *2	98	55	75.0	0.74	
Maricopa *1	117	64	84.0	T.	
Mesa †	110	56	84.6	0.12	
Mount Huachuca	98	50	74.5	1.33	
Music Mountain	112	49	81.1	0.13	
Natural Bridge	.....	.....	.....	0.76	
Oracle	101	53	76.6	0.70	
Oro	.....	.....	.....	2.60	
Oro Blanco	102	53	76.5	1.52	
Pantano *1	101	62	79.8	0.22	
Parker	119	52	86.6	0.22	
Peoria †	112	59	86.4	0.06	
Phœnix	106	50	81.2	0.00	
Pinal Ranch	.....	.....	.....	1.33	
Prescott	.....	.....	.....	0.88	
San Carlos †	112	49	82.0	0.20	
San Simon *1	103	60	80.1	T.	
Showlow	.....	.....	.....	1.69	
Signal †	111	57	84.7	1.13	
Snowflake	101	30	67.6	1.04	
Strawberry	96	33	65.6	1.14	
Sulphur Spring Valley	.....	.....	.....	0.03	
Arizona—Cont'd.					
Texas Hill *1	117	75	91.4	0.12	
Tombstone	99	55	77.4	0.38	
Tucson *c* †	106[2]	58[5]	83.2[2]	0.20	
Walnut Grove	.....	.....	.....	0.11	
White Hills	109	57	85.5	T.	
Willcox *1	98	68	82.2	0.03	
Arkansas.					
Amity	91	64	78.0	6.08	
Arkansas City †	.....	.....	.....	5.75	
Beebranch	94[3]	60[3]	77.6[3]	2.47	
Blanchard Springs †	96	65	79.0	7.05	
Brinkley	94	65	80.3	4.38	
Camden *a* †	.....	.....	.....	4.23	
Camden *b* †	92	65	78.9	4.08	
Canton *1	94	68	79.0	.....	
Conway	99	67	81.4	5.52	
Corning	98	62	78.5	3.33	
Dallas	93	63	78.0	4.05	
Dardanelle	.....	.....	.....	5.81	
Elon †	95	66	79.2	7.71	
Fayetteville †	91	61	75.4	5.69	
Forrest	94	65	79.8	3.50	
Fulton †	.....	.....	.....	7.82	
Hardy	95	64	77.9	3.35	
Helena *a* †	.....	.....	.....	3.11	
Helena *b*	98	67	81.6	2.48	
Hot Springs *a*	95	62	79.6	5.23	
Hot Springs *b*	.....	.....	.....	4.69	
Jonesboro	96	64	79.7	5.29	
Keesees Ferry †	93	62	77.2	5.30	
Lacrosse †	93	64	77.8	4.76	
Lonoke *1	100	70	81.1	4.12	
Luna Landing *6	95	70	78.9	.....	
Malvern †	96	62	79.6	3.23	
Marianna *1	96	72	81.6	.....	
Marvell	97	64	80.9	2.90	
Mena *1	91	67	77.6	5.48	
Moore	.....	.....	.....	4.72	
Mossville	87	60	72.6	9.96	
Mount Nebo	86	62	75.0	5.49	
New Gascony	.....	.....	.....	2.49	
Newport *a* †	.....	.....	.....	2.35	
Newport *b*	97	52	79.9	2.06	
Newport *c* †	97	65	80.2	2.59	
Oregon *1	90	60	72.4	.....	
Osceola	98	63	80.4	4.01	
Ozark †	96	65	79.0	11.15	
Picayune †	95	62	78.4	9.59	
Pinebluff †	97	68	81.8	2.57	
Pocahontas	92	64	77.8	2.64	
Pond	89	61	75.0	5.22	
Prescott	98	68	80.9	5.80	
Rison	97	60	79.7	4.60	
Russellville	95	67	79.6	3.36	
Silver Springs †	92	61	75.6	5.38	
Spielerville	97	63	78.6	4.15	
Stamps	95	64[3]	80.8[3]	7.36	
Stuttgart †	95	66	80.8	1.85	
Texarkana †	98	61	80.8	10.19	
Warren †	95	66	79.8	3.71	
Washington *† 1	94	70	78.7	5.68	
Wiggs *1	92	65	79.0	6.51	
Winslow	86	60	72.6	7.93	
Witts Springs †	90	62	74.2	7.31	
California.					
Arlington Heights	99	47	70.7	0.00	
Asti	105	43	71.0	.....	
Ballast Point L. H	.....	.....	.....	0.00	
Bear Valley	.....	.....	.....	2.00	
Berkeley	91	49	63.0	0.24	
Bishop †	96	43	69.1	T.	
Blue Lakes City	106	38	71.4	0.22	
Boca *1	88	38	54.5	1.00	
Bodie †	82	17	52.2	0.01	
Bowmans Dam	.....	.....	.....	2.12	2.0
Caliente *1	99	52	72.2	0.00	
Campbell	96	41	64.2	0.16	
Cape Mendocino L. H	.....	.....	.....	2.30	
Cedarville †	87	30	60.5	0.84	2.0
Centerville *1	104	57	67.7	0.24	
Chico *1	104	55	77.1	0.00	
Cisco *1	74	30	50.9	1.10	3.0
Claremont †	95	.....	.....	0.00	
Corning *1	112	60	78.3	0.00	
Craftonville	101	51	75.7	0.00	
Crescent City †	81	43	56.4	2.31	
Crescent City L. H	.....	.....	.....	2.40	
Delano *1	108	61	82.3	0.00	
Delta *1	96	46	73.1	1.40	
Descanso *5	96	33	62.6	0.00	
Drytown	104	42	70.2	0.36	
Dunnigan *1	105	51	71.1	0.09	
Durham *1	100	53	74.6	0.05	
East Brother L. H	.....	.....	.....	0.10	
Edmanton *1	85	35	58.9	2.11	
Elsinore	102	46	72.6	0.01	
California—Cont'd.					
Escondido	102	40	68.4	0.00	
Fallbrook	.....	.....	.....	0.07	
Folsom City *1	106	55	75.7	0.30	
Fordyce Dam	.....	.....	.....	2.13	2.0
Fort Bragg †	.....	.....	.....	0.25	
Fort Romie	105	40[3]	65.4	0.04	
Fort Ross	83	45	57.8	0.63	
Georgetown	94	40	67.0	1.23	
Goshen *1	106	59	82.0	0.00	
Grand Island *6	102	48	75.3	0.00	
Grass Valley	.....	.....	.....	1.27	
Greenville †	91	30	58.5	2.39	
Healdsburg *1	90	40	62.6	0.41	
Hill Ranch	106	44	72.4	T.	
Hollister *1	103	41	65.0	0.00	
Humboldt L. H	.....	.....	.....	1.13	
Hydesville	84	42	58.8	1.12	
Indio *1	113	69	87.9	0.00	
Iowa Hill *1	89	45	67.0	1.49	
Jackson	96	40	69.4	0.43	
Jolon	.....	.....	.....	T.	
Keene *1	96	49	69.8	0.00	
Kennedy Gold Mine	98	41	68.8	0.30	
King City *1	104	45	60.7	.....	
Kingsburg *1	105	60	80.4	0.00	
Lagrange *5	107	49	78.3	0.00	
Laporte *† 1	80	34	56.5	2.73	7.0
Lemoore *a* *1	105	56	79.2	0.00	
Lick Observatory	85	33	62.0	0.38	
Limekiln	108	46	76.8	.....	
Lime Point L. H	.....	.....	.....	0.14	
Lodi	99	48	71.0	0.06	
Los Gatos *b*	92	47	65.1	0.23	
Lytton Springs	96	46	68.0	0.61	
Malakoff Mine	92	39	65.7	1.70	
Mammoth Tank *1	116	80	97.5	0.00	
Manzana	101	44	76.7	.....	
Mare Island L. H	.....	.....	.....	0.58	
Merced *1	106	58	75.7	0.00	
Mills College	.....	.....	.....	0.46	
Milo	.....	.....	.....	0.00	
Milton (near) *1	101	52	73.3	0.09	
Modesto *1	102	56	73.4	0.00	
Mohave *1	104	50	80.0	0.00	
Mokelumne Hill *3	.....	51	69.7	0.22	
Monterey *1	92	53	62.1	0.06	
Mountain View	.....	.....	.....	0.09	
Mount Frazier	.....	.....	.....	T.	
Mount Tamalpais	86	38	61.9	1.05	
Napa *b*	102	42	65.7	0.37	
Needles	113[6]	67	89.4[6]	0.06	
Nevada City	89	38	63.3	1.27	
Newhall *1	100	55	72.6	0.00	
North Ontario	91	44	67.4	0.00	
North San Juan *1	93	48	69.0	0.74	
Oakland *a*	89	50	63.7	0.39	
Ogilby *1	115	75	93.8	0.00	
Oleta *1	95	47	67.3	0.35	
Orland *1	110	60	81.6	0.00	
Palermo	107	47	76.1	0.12	
Paso Robles *b*	105	36	67.2	0.00	
Peachland *5	92	52	65.4	0.41	
Piedras Blancas L. H	.....	.....	.....	0.10	
Pigeon Point L. H	.....	.....	.....	0.05	
Pilot Creek	.....	.....	.....	1.61	
Pine Crest	93	50	66.0	0.00	
Placerville	98	39	67.6	0.66	
Point Ano Nuevo L. H	.....	.....	.....	0.00	
Point Arena L. H	.....	.....	.....	0.61	
Point Bonita L. H	.....	.....	.....	0.73	
Point Conception L. H	.....	.....	.....	0.00	
Point Firmin L. H	.....	.....	.....	0.00	
Point George L. H	.....	.....	.....	0.73	
Point Hueneme L. H	.....	.....	.....	1.25	
Lobos	82	48	57.2	0.25	
Point Loma L. H	.....	.....	.....	0.00	
Point Montara L. H	.....	.....	.....	0.18	
Point Pinos L. H	.....	.....	.....	0.00	
Point Reyes L. H	.....	.....	.....	0.42	
Point Sur L. H	.....	.....	.....	0.09	
Pomona (near)	102	44	69.8	0.00	
Poway *3	96	60	64.3	0.00	
Quincy †	88	32	62.2	1.84	
Redding *b* †	99	43	73.7	0.15	
Represa	96	48	72.0	0.35	
Rio Vista	101	47	70.7	0.06	
Roe Island L. H	.....	.....	.....	0.31	
Rosewood	106	35	72.2	0.26	
Sacramento *a*	98	48	72.8	0.16	
Salinas *1	90	51	63.2	0.30	
Salton *1	120	73	91.7	T.	
San Bernardino †	99	45	70.8	0.00	
San Leandro *1	96	56	63.2	0.36	
San Luis L. H	.....	.....	.....	0.00	
San Mateo *1	94	58	70.2	0.19	
San Miguel *1	101	52	70.8	0.00	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Santa Barbara *a*	90	48	64.0	0.00	
Santa Barbara L. H	.....	.....	.....	0.00	
Santa Clara *a*	.....	.....	.....	0.08	
Santa Cruz *b* †	100	40	63.2	0.06	
Santa Cruz L. H	.....	.....	.....	1.00	
Santa Maria*	97	48	66.0	0.00	
Santa Monica *1	80	55	61.6	0.00	
Santa Rosa *1	94	49	65.3	0.17	
Saticoy	.....	.....	.....	0.00	
Shasta	.....	.....	.....	0.12	
Sierra Madre	92	49	67.8	0.00	
Sonoma *5	.....	.....	.....	0.27	
S. E. Farallone L. H	.....	.....	.....	0.00	
Stockton *a*	98	46	69.4	0.03	
Summerdale †	85	36	61.2	0.00	
Susanville †	87	35	61.3	1.02	
Sutter Creek *5	93	40	66.4	0.00	
Tehama *1	101	58	78.5	0.11	
Templeton *1	105	50	69.5	0.00	
Trinidad L. H	.....	.....	.....	1.11	
Truckee *1	90	38	59.0	0.00	
Tulare *c*	110	48	78.1	0.00	
Turlock	99	60	78.4	0.00	
Ukiah	95	42	65.7	0.65	
Upperlake	98	44	67.7	0.58	
Upper Mattole *1	85	48	60.6	3.32	
Vacaville *a* *1	101	56	72.6	0.00	
Ventura †	100	39	60.8	0.00	
Visalia	107	41	73.4	0.00	
Volcano Springs *1	123	79	99.2	0.00	
Walnut Creek	104	49	72.7	0.33	
Wheatland	107	47	73.6	0.17	
Williams *1	101	54	76.5	0.00	
Wilmington *5	100	49	65.8	0.00	
Wire Bridge *5	97	52	73.1	0.88	
Yerba Buena L. H	.....	.....	.....	0.00	
Yreka †	94	32	63.4	0.10	
Yuba City *5	102	63	80.6	0.00	
Colorado.					
Altman[g]	83	28	51.0	.....	
Antlers †	99	35	68.0	0.82	
Arkins	.....	.....	.....	1.86	
Boulder	95	42	66.6	1.51	
Boxelder	.....	.....	.....	1.66	
Breckenridge †	84	17	48.8	1.14	T.
Canyon †	102	43	69.0	1.07	
Castlerock	89	35	63.3	1.82	
Cedaredge	94	27	63.4	0.33	
Cheyenne Wells	97	39	67.8	3.95	
Collbran	.....	.....	.....	0.37	
Colorado Springs †	92	40	62.1	3.61	
Crook	108	40	70.4	0.87	
Delta	105	34	70.5	0.40	
Dumont †	.....	.....	.....	2.60	
Durango	92	30	62.9	0.62	
Fleming	.....	.....	.....	1.27	
Fort Collins †	97	36	64.0	1.37	
Fort Morgan	106	38	69.7	1.30	
Fox	.....	.....	.....	3.87	
Garnett	89	20	57.2	0.65	
Georgetown	85	30	57.0	.....	
Gleneyrie †	88	37	61.3	1.65	
Grand Junction †	100	41	72.6	0.05	
Greeley	99	39	66.9	1.09	
Gunnison[g]	96	32	61.8	.....	
Hamps	93	35	62.6	1.03	
Hoehne	97	40	67.9	1.66	
Holly	.....	.....	.....	3.00	
Holyoke	.....	.....	.....	1.92	
Holyoke (near)	105	35	69.8	1.13	
Hugo	.....	.....	.....	1.10	
Husted †	94	35	62.2	2.71	
Lake Moraine †	77	27	50.0	3.68	0.8
Lamar †	102	42	72.3	3.67	
Laporte	.....	.....	.....	1.27	
Las Animas †	101	48	70.9	2.45	
Leadville (near) *† [1]	78	32	53.1	0.36	
Leroy †	104	38	67.6	1.31	
Longs Peak	79	23	50.4	2.06	4.0
Loveland	.....	.....	.....	1.59	
Meeker	98	26	62.0	0.40	
Millbrook	93	32	59.8	1.09	
Minneapolis †	99	45	71.0	3.41	
Moraine †	85	26	55.2	1.93	T.
Pagoda †	95	25	60.2	1.57	
Paonia	.....	.....	.....	0.53	
Rangely †	101	33	67.1	T.	
Redcliff	.....	.....	.....	0.09	
Rockyford	99	41	69.5	3.16	
Ruby	.....	.....	.....	0.12	1.0
Saguache †	89	20	58.7	0.82	
Salida	96	31	62.1	1.82	
San Luis †	86	26	54.7	1.45	
Santa Clara *1	90	38	59.2	3.23	
Seguro	.....	.....	.....	1.72	
Seibert †	.....	.....	.....	3.01	
Colorado—Cont'd.					
Smoky Hill Mine	88	27	55.7	3.51	T.
Springfield	.....	.....	.....	2.02	
Stamford *1	80	30	47.4	2.61	
Strickler Tunnel	.....	.....	.....	2.84	9.5
T. S. Ranch †	93	35	67.0	0.15	
Vilas	.....	.....	.....	1.81	
Wagon Wheel	81	18	49.0	1.00	
Walden	87	17	54.2	1.03	
Wallet	.....	.....	.....	3.26	
Wray †	100	40	69.6	2.98	
Yuma	.....	.....	.....	2.70	
Connecticut.					
Canton †	90	41	66.2	2.71	
Colchester	88	41	66.1	0.79	
Falls Village	.....	.....	.....	2.99	
Greenfield Hill	.....	.....	.....	0.55	
Hartford *a*	92	44	68.3	1.81	
Hartford *b*	.....	.....	.....	1.59	
Hawleyville	91	41	67.6	0.57	
Lake Konomoc	.....	.....	.....	1.70	
Middletown	93	43	69.0	0.39	
New London †	86	47	63.1	1.09	
North Franklin	.....	.....	.....	1.89	
North Grosvenor Dale	.....	.....	.....	2.31	
Norwalk	91	44	67.5	0.79	
Pomfret	84	40	67.2	2.40	
Southington	90	42	67.0	0.53	
South Manchester	.....	.....	.....	1.48	
Storrs	87	44	65.2	2.48	
Voluntown †	87[b]	39[c]	65.4[c]	3.44	
Waterbury	93	40	67.8	0.94	
West Cornwall †	86	45	65.8	2.87	
West Simsbury	.....	.....	.....	2.23	
Winsted *1	90	55	66.6	.....	
Delaware.					
Dover	94	51	71.0	2.07	
Milford	95	54	73.2	2.40	
Millsboro	97	52	70.8	3.64	
Newark	94	49	70.8	3.99	
Seaford	95	52	71.5	3.12	
District of Columbia.					
Distributing Reservoir *5	92	59	76.0	.....	
Receiving Reservoir *5	93	58	75.0	.....	
West Washington	97	51	73.8	1.62	
Florida.					
Archer †	100	59	78.6	2.88	
Bartow	99	60	82.8	4.27	
Boca Raton †	89	66	79.8	0.28	
Brooksville †	97	64	81.0	4.74	
Carrabelle †	94	70	82.0	T.	
De Funiak Springs	98	64	79.6	3.67	
Earnestville	100	63	82.6	9.07	
Estero *1	93	68	81.0	.....	
Eustis †	101	63	82.0	5.94	
Federal Point †	95	61	79.5	3.04	
Fort Meade	.....	60	.....	8.64	
Gainesville	100	64	82.6	3.28	
Grasmere †	101	61	83.2	2.62	
Haywood	98	.....	.....	3.11	
Homeland	99	65	83.4	.....	
Huntington	99	64	81.2	2.25	
Kissimmee	97	55	82.2	5.75	
Lake Butler	98	60	81.8	3.90	
Lake City †	101	59	81.4	2.42	
Lakemont	100	63	83.2	0.84	
Lemon City	91	65	81.0	0.70	
Maccienny †	.....	.....	.....	5.57	
Manatee	100	60	80.7	5.35	
Merritts Island	94	66	81.2	0.64	
Myers †	93	61	80.4	2.83	
New Smyrna	94	58	77.4	2.55	
Ocala †	100	60	81.4	3.50	
Orange City	98	66	83.6	5.18	
Orange Park	98	59	81.4	1.35	
Orlando †	97	63	81.7	1.13	
Plant City	99	58	81.2	3.08	
St. Andrew	96	66	82.0	2.81	
St. Francis †	97	54	77.6	3.57	
St. Francis Barracks	95	60	78.8	1.10	
Sebastian	92	62	77.6	1.05	
Switzerland *1	.....	.....	.....	2.81	
Tallahassee †	96	63	80.8	4.49	
Tarpon Springs †	92	66	80.0	5.82	
Wausau	99	67	82.6	5.00	
Georgia.					
Adairsville †	96	61	78.2	5.89	
Alapaha	100	58	81.6	3.18	
Albany †	102	63	83.9	5.92	
Allentown †	101	63	83.5	2.29	
Americus †	102	61	83.7	3.18	
Athens *b* †	97	63	80.4	1.53	
Bainbridge	100	64	81.8	3.16	
Bellville	102	62	80.9	4.75	
Blakely †	95	68	81.6	2.89	
Brag	103	59	81.8	3.14	
Camak	99	62	81.1	4.02	
Georgia—Cont'd.					
Canton †	.....	.....	.....	1.47	
Cedartown *	96	58	77.4	2.72	
Clayton †	96	54	74.6	2.59	
Columbus	98	62	82.1	2.24	
Covington	102	62	80.2	1.46	
Crescent	95	60	78.8	3.41	
Dahlonega †	93	56	74.2	3.87	
Diamond	96	52	73.2	3.04	
Eastman	99	.....	.....	1.43	
Elberton †	98	64	80.4	2.37	
Fleming †	100	.....	.....	6.94	
Fort Gaines	96	64	82.0	4.09	
Franklin	96	62	79.0	2.57	
Gainesville	94	62	76.8	1.23	
Gillsville †	100	62	79.5	2.64	
Greenbush	96	55	76.2	5.75	
Griffin	99	61	79.1	2.99	
Hephzibah [g]	.....	.....	84.2	1.40	
Jesup	.....	60	.....	5.68	
Lagrange †	98	65	81.3	3.73	
Leverett	104	57	81.0	3.05	
Louisville	100	62	81.8	1.77	
Lumpkin	98	67	81.2	3.75	
Macon	102	60	81.6	2.63	
Marietta	94	60	76.8	1.94	
Marshallville †	98	68	81.8	3.76	
Mauzy	98	60	80.9	6.64	
Millen	100	63	82.0	3.73	
Morgan †	98	59	79.0	5.97	
Mount Vernon	101	69	84.4	6.80	
Newnan	100	65	80.0	2.93	
Point Peter	101	57	80.2	1.82	
Poulan †	102	57	81.4	2.39	
Quitman †	99	58	81.8	3.46	
Ramsey	99	50	77.4	3.95	
Rome †	99	55	78.2	3.00	
Talbotton †	96	63	80.2	1.59	
Tallapoosa	95	62	77.9	4.32	
Thomasville †	98	64	82.4	3.57	
Toccoa †	96	54	77.8	0.89	
Union Point	96	51	77.9	1.82	
Washington †	98	65	81.4	2.51	
Waycross	99	61	81.4	2.50	
Waynesboro	97	60	79.6	3.92	
West Point	99	63	81.8	6.00	
Idaho.					
Albany Falls	86	35	59.6	1.72	
American Falls	100*	34	65.0	0.28	
Blackfoot †	96	32	64.4	0.55	
Boise Barracks	105	34	66.3	0.10	
Burnside †	86	32	58.6	1.79	
Coeur d' Alene	92	39	62.1	.....	
Corral *1	91	39	59.0	0.52	
Downey	94	30	58.9	1.28	
Fort Sherman †	93	34	61.2	0.48	
Gimlet †	90	26	57.8	1.47	T.
Gray	86	25	55.0	1.75	0.5
Kootenai †	89	31	62.0	1.91	
Lake	86	30	51.3	1.21	T.
Lakeview	84	37	60.0	0.99	
Lewiston	94	41	66.3	0.87	
Lost River	95	30	59.8	1.26	T.
Marysville	93	23	59.6	0.15	
Moscow	86	32	57.9	1.31	
Murray †	93	34	57.8	2.02	
Nampa	102	34	66.1	0.29	
New Plymouth	99	37	68.4	0.63	
Oakley	100	31	65.4	0.58	
Paris	93	26	58.0	0.82	
Payette	103	38	70.9	0.54	
Pollock †	100	36	62.3	1.08	
St. Maries	90	35	61.4	0.83	
Salubria	101	33	64.6	0.36	
Soldier †	96	27	58.0	0.88	
Swan Valley †	89	27	58.1	0.82	
Warren †	90	24	55.0	1.15	
Weston [g]	84	34	59.4	1.07	
Yellow Jacket	.....	.....	.....	2.10	
Illinois.					
Albion †	95	57	76.6	3.35	
Alexander †	94	51	75.6	5.14	
Ashton *† [1]	90	55	71.3	3.00	
Atwood *b*	.....	.....	.....	3.58	
Aurora *a*	92	46	70.9	5.39	
Aurora *b*	92	46	70.6	5.86	
Beardstown	.....	.....	.....	2.18	
Bloomington †	97	49	74.6	4.02	
Cambridge	91	53	71.6	9.88	
Carlinville †	92	53	75.2	3.66	
Carlyle	.....	.....	.....	6.48	
Carrollton	90	56	73.4	2.94	
Charleston	93	54	75.0	2.79	
Chemung	90	48	68.8	5.97	
Chester	.....	.....	.....	3.79	
Cisne †	.....	.....	.....	5.05	
Coatsburg	94	55	74.6	5.43	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cobden†	93	57	76.2	7.83	
Danville	94	46	73.6	6.37	
Decatur†	93	47	74.0	2.39	
Dixon†	92	48	70.9	2.49	
Dwight†	96	43	72.6	3.79	
East Peoria†				3.71	
Effingham†	92	55	75.3	6.98	
Elgin	90	47	69.6	8.23	
Equality	95	60	79.0	2.48	
Fort Sheridan	92	47	67.2	2.56	
Friendgrove†				4.28	
Galva†	91	52	71.2	9.86	
Glenwood *†	92[j]	56[f]	68.8[h]	3.89	
Grafton†				3.49	
Grayville	95	59	78.8	4.09	
Greenville†	95	55	77.0	4.28	
Griggsville†	92	51	74.0	4.94	
Halfway				2.73	
Halliday *[3]	94	68	77.0	4.17	
Havana†	92	58	75.5	4.58	
Henry	95	50	74.0	3.61	
Hillsboro†	92	52	75.1	3.39	
Joliet†	92	48	71.2	7.89	
Kankakee *a*				1.72	
Kishwaukee	92	41	67.0	5.55	
Knoxville *a*	90	53	71.4	5.02	
Lagrange†	90	45	69.8	6.92	
Laharpe	92	52	74.0	2.59	
Lanark†	95	44	69.8	2.12	
Lexington	91	46	72.1	2.21	
Loami†				6.14	
McLeansboro†	93	57	76.8	4.99	
Martinsville	94	50	74.4	4.20	
Martinton†	94	46	72.3	2.65	
Mascoutah	95	55	75.6	5.62	
Mattoon	94	51	75.3	2.30	
Minonk†	91	47	71.6	2.92	
Monmouth†	93	50	72.2	4.67	
Morrisonville†	90	48	73.3	2.74	
Mount Carmel†				8.16	
Mount Pulaski	96	53	75.6	3.71	
Mount Vernon	95	52	74.2	5.28	
New Burnside†	96	55	77.8	2.77	
Olney *a*	94	54	76.4	1.10	
Oswego *†	90	51	69.7	4.51	
Ottawa†	94	48	72.3	5.80	
Palestine†	95	50	74.9	4.06	
Pana	94	54	75.0	2.31	
Paris	91	52	74.2	3.84	
Peoria *a*†				4.07	
Peoria *b*†	95	53	74.6	3.37	
Philo†	93	48	72.6	3.78	
Plumhill†	92	55	74.6	5.32	
Rantoul†	91	49	73.0	4.99	
Reynolds	90	53	71.4	3.21	
Riley†	91	49	69.8	7.74	
Robinson	92	51	74.8	4.28	
Rockford	91	47	69.4	2.79	
Roundgrove†	90	49	72.0	2.98	
St. Charles *†[1]	90	50	69.0	4.55	
St. John†	94	57	77.8	3.15	
Scales Mound	90	43	69.6	3.19	
Streator†	92	50	73.3	3.24	
Sycamore†	90	45	70.0	3.47	
Tilden	92	57	76.4	5.09	
Tiskilwa †	95	50	71.8	2.85	
Tuscola†	93	47	73.2	3.93	
Walnut†	94	50	72.0	3.98	
Wheaton				6.03	
Winchester *[1]	90	58	73.2	5.21	
Winnebago†	90	46	69.5	3.65	
Indiana.					
Anderson†	92	49	72.0	1.61	
Angola				2.18	
Auburn	94	39	70.7	1.21	
Bloomington†	92	52	75.9	3.63	
Bluffton†	95	45	71.8	2.01	
Boonville	96	56	78.4	2.70	
Bright	96	52	74.7	1.20	
Butlerville†	93	47	73.6	2.14	
Cambridge City†	91	43	70.4	3.37	
Columbia City *[1]	90	50	71.0	2.49	
Columbus†	91	45	71.8	4.27	
Connersville†	94	46	72.9	3.23	
Crawfordsville				7.02	
Delphi†	93	47	72.2	5.32	
Edwardsville *†[1]	91	61	76.5	5.77	
Farmland†	90	48	71.0	2.73	
Fort Wayne	92	45	70.9	2.48	
Franklin *[1]	90	61	73.7	3.53	
Greencastle†	87	54	71.9	4.18	
Greensburg	94	51	75.0	1.85	
Hammond†	96	49	68.0	2.27	
Huntington	92	48	71.2	3.73	
Jasper†	94	52	75.9	3.00	
Jeffersonville	93	55	76.2	5.51	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Knightstown†	94	47	72.4	3.94	
Kokomo†	96	50	73.1	4.45	
Lafayette†	91	50	71.9	4.16	
Laporte	95	51	72.0	3.64	
Logansport *b*†	94	52	73.1	2.50	
Madison	94	52	76.2	5.57	
Marengo†	95	50	76.8	5.59	
Marion†	93	47	71.6	4.29	
Markle	92	49	72.0	3.10	
Mauzy†	92	47	72.0	4.67	
Michigan City *[10]	95	50	68.5		
Mount Vernon†				2.20	
Northfield †	91	45	70.6	3.37	
Paoli	95	50	75.1	4.87	
Princeton *[1]	97	58	76.2	7.80	
Richmond	91	45	71.7	2.60	
Rockport	93	59	76.5	2.97	
Rockville†	89	47	72.0	6.18	
Salem				1.50	
Scottsburg	94	52	77.4	2.60	
Seymour	92	54	74.2	5.30	
Shelbyville	92	50	73.8	2.67	
South Bend†	91	48	71.1	3.41	
Syracuse†				2.98	
Terre Haute†	93	55	75.2	6.47	
Topeka†	89	47	69.2	1.88	
Valparaiso†	98	50	72.3	3.55	
Vevay	95	50	76.8	5.55	
Vincennes				2.55	
Warsaw	91	48	70.4	3.51	
Washington†	93	55	75.4	3.34	
Winamac	99	45	72.8	3.48	
Worthington†	94	50	74.6	2.73	
Indian Territory.					
Healdton†	95	59	78.2	4.79	
Kemp	102	62	79.7	8.55	
Lehigh†	95	61	77.9	3.07	
Purcell	96	58	76.9	6.42	
South McAlester†				8.15	
Tulsa†				5.64	
Wagoner	95	64	78.4	5.26	
Iowa.					
Adair				8.72	
Afton	98	45	73.6	5.76	
Albia	98	53	73.6	5.16	
Algona *[1]	92	56	72.0	4.63	
Alta *a*†	94	48	70.5	3.41	
Amana†	93	52	72.6	2.54	
Ames *b*.	92	53	71.0	7.10	
Ames (near)				5.00	
Atlantic†	93	50	70.4	8.74	
Audubon	93	48	71.0	2.74	
Belknap	92	55	72.9	6.25	
Belleplaine				3.80	
Bonaparte†	91	53	72.4	9.01	
Britt	92	43	69.9	3.96	
Carroll	93	47	70.6	2.99	
Cedarfalls	91	49	71.9	5.53	
Cedar Rapids†	95	53	73.2	3.60	
Centerville	91	53	73.3	4.61	
Chariton	91	54	71.8	4.77	
Charles City	92	45	69.4	2.63	
Clarinda†	99	58	75.0	2.99	
Clear Lake	91	48	68.6	3.74	
Clinton	93	51	72.2	8.08	
College Springs	95	55	74.2	3.94	
Corning†	93	53	72.6	5.35	
Council Bluffs	96	55	75.2	3.14	
Cresco†	91	43	67.6	2.53	
Decorah†	91	44	68.8	2.88	
Delaware *[3]	90	50	69.7	5.62	
Denison†	91	47	68.7	2.79	
Desoto	91	52	72.6	9.35	
Dows	90	47	69.0	4.91	
Eldon	96	52	73.9	4.96	
Eldora	95	45	71.2	6.61	
Elkader†	94	44	71 2	3.36	
Estherville	97	43	68.8	3.48	
Fairfield †	92	50	71.8	5.54	
Fayette†	92	43	68.2	3.53	
Forest City	90	42	73.4	7.20	
Fort Madison				3.09	
Fredericksburg				3.30	
Galva	95[e]	52[e]	72.1[e]	3.34	
Glenwood†	95	47	72.3	4.66	
Grand Meadow *[1]	90	50	67.6	2.91	
Greene	94	46[i]	71.1[e]	3.25	
Greenfield	94	50	72.6	12.48	
Grinnell	90	54	71.7	4.67	
Grundy Center	91	50	69.6	7.02	
Guthrie Center	96	51	71.3	4.29	
Hampton	92	49	69.4	4.95	
Hawkeye				3.73	
Hedrick *[1]	94[f]	60[f]	74.7[f]	4.11	
Hopeville†	91	55	71.6	6.07	
Humboldt†	92	48	71.2	5.67	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Independence†	90	47	69.2	4.65	
Indianola †	91	54	72.2	5.35	
Iowa City *a*	93	53	72.5	3.26	
Iowa Falls†	93	46	70.2	4.15	
Keosauqua	93	55	74.4	5.18	
Knoxville	94	54	73.1	3.70	
Lamoni	92	54	72.8	4.62	
Lansing	91	45	71.0	3.00	
Larchwood				4.23	
Larrabee†	96	44	69.8	5.90	
Leclaire				2.53	
Lemars	94	48	70.0	4.72	
Lenox	92	55	71.8	3.01	
Logan†	98	53	73.4	3.25	
Maple Valley				3.10	
Maquoketa	92	45	70.2	2.20	
Marshall†	92	50	70.3	6.48	
Mason City	92	46	68.2	3.03	
Mooar	91	50	72.2	5.04	
Mountayr	94	57	72.8	4.55	
Mount Pleasant *[1]	90	62	75.0	5.87	
Mount Vernon *[1]	92	59	72.7	2.69	
Mount Vernon *b*	92	52	71.8	2.87	
New Hampton	90	47	69.1	3.39	
Newton†	93	53	73.2	4.66	
North McGregor				2.40	
Northwood	92	43	68.3	3.00	
Odebolt	94	49	71.8	4.94	
Ogden	91	48	71.1	5.88	
Olin	89	46	70.0	1.90	
Osage *[3]		56	68.5	3.15	
Osceola	97	54	71.8	4.95	
Oskaloosa†	94	49	71.8	2.40	
Ottumwa	94	55	73.6	4.45	
Ovid†	89	53	72.0	5.42	
Pella	87	52	69.3	2.42	
Pioneer	92[c]	49[h]	70.3[c]	5.55	
Plover	95	45	71.2	4.22	
Primghar	96	45	72.8	5.10	
Red Oak	94	52	73.8	4.66	
Ridgway	93	50	70.0	3.15	
Rockwell City	94	47	70.8	3.22	
Ruthven	94	44	68.8	5.41	
Sac City†	92	47	70.3	3.83	
Sibley	94	44	68.1	4.99	
Sidney	94	57	72.4	6.40	
Sigourney	98	50	73.6	3.53	
Spencer	93	49	69.9	9.17	
Spirit Lake†	93	45	68.5	5.31	
Tara	90			3.50	
Thurman	96	54	73.5	7.62	
Toledo	93	49	72.1	4.37	
Vinton *[1]	90	57	70.9	2.76	
Washington	91	51	71.4	2.79	
Washta				4.67	
Waterloo	91	49	70.7	4.31	
Waverly	91	50	70.6	5.03	
Webster City	93	52	71.6	5.28	
Westbend *†	94	51	69.2	6.21	
West Branch	91[c]	51[c]	71.5[c]	4.37	
Whitten *[1]	92	58	71.7	5.82	
Wilton Junction †	96	52	72.5	3.47	
Winterset †	93	51	71.3	11.13	
Kansas.					
Abilene†	96	57	76.2	4.48	
Achilles				3.00	
Altoona *[3]	94	65	75.0	6.98	
Anthony				5.22	
Atchison †	93	57	74.2	7.22	
Augusta	94	59	76.0	4.48	
Baker	93	57	74.2	4.80	
Beloit†	102	50	74.6	5.46	
Burlington †	94	52	75.9	8.33	
Campbell	101	55	76.0	3.12	
Chanute	94[d]	55[d]	76.8[d]	5.85	
Colby†	98	40	70.2	2.85	
Columbus	95	59	76.9	7.15	
Coolidge†				2.86	
Cunningham†	103	54	75.8	6.55	
Delphos	100	53	75.3	3.33	
Dresden				4.92	
Ellinwood †	96	54	73.6	4.00	
Emporia	90	60	74.6	4.00	
Englewood †	102	52	75.8	5.57	
Eskridge	92	61	74.8	6.10	
Eureka				5.30	
Eureka Ranch†	100	48	73.0	2.25	
Fallriver	92	59	75.6	6.62	
Fanning				5.49	
Fort Riley †	91	60	75.0	4.40	
Fort Scott†.	92	61	75.8	9.96	
Frankfort	98	55	75.2	2.83	
Gibson	99	47	72.4	2.22	
Gove *[1]	96	56	73.4	5.41	
Grenola	95	59	76.0	5.70	
Halstead	94	58	74.7	7.59	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hays	98	49	72.6	1.97	
Horton	94	59	74.7	4.24	
Hoxie				3.93	
Hutchinson	94	58	74.8	5.93	
Independence	101	62	78.8	4.60	
Lawrence	92	60	75.8	3.59	
Lebanon				2.54	
Lebo†	93	61	75.6	8.15	
Linn				8.07	
Macksville	95	52	72.2	3.61	
McPherson	95	56	74.9	5.90	
Manhattan *b*	95	59	76.0	4.99	
Manhattan *c*	94	57	75.4	4.38	
Marion†	95	60	78.8	4.10	
Meade†	106	53	75.6	3.14	
Medicine Lodge†	99	56	77.4	7.97	
Minneapolis†	102	51	76.6	1.92	
Morantown†	90	61	74.8	9.06	
Mounthope*[1]	95	65	76.1	4.77	
Ness City	99	55	76.0	2.93	
Newton	94	59	75.2	5.75	
Norwich				4.84	
Oberlin				3.43	
Olathe†	95	61	75.8	4.81	
Osage City†	93	62	76.0	3.19	
Oswego	96	60	78.5	6.53	
Ottawa	93	57	74.4	5.62	
Phillipsburg	102	50	72.7	3.57	
Pratt	101	60	78.9	4.30	
Rome*†	96	58	74.8	2.78	
Russell	100	49	76.4	2.34	
Salina†	101	53	76.8	2.92	
Sedan†	96	62	77.8	5.49	
Toronto	92	58	75.6	4.71	
Ulysses				5.73	
Viroqua†	101	47	73.2	3.46	
Wallace*[1]				1.43	
Wamego*[1]	94	64	76.3	6.92	
Kentucky.					
Alpha*[3]				3.69	
Ashland	95	49	74.8	3.10	
Bardstown†	96	53	75.7	5.91	
Blandville†	92	61	77.3	7.79	
Bowling Green *b*†	94	58	78.5	3.87	
Burnside†				3.10	
Caddo	95	54	75.8	2.15	
Canton*[1]	96	64	77.2	5.23	
Carrollton	96	58	78.4	2.90	
Catlettsburg				4.52	
Earlington	96	52	77.6	3.35	
Edmonton†	90	55	74.2	5.45	
Ensor	92	57	77.4	2.84	
Eubank	95	50	73.0	5.65	
Falmouth†				2.76	
Fords Ferry	94	54	77.1	2.98	
Frankfort				6.62	
Georgetown	94	54	75.2		
Greensburg†	95	50	75.7	1.75	
Henderson†	96	61	79.0	2.08	
Hopkinsville†	96	59	78.6	4.91	
Irvington	96	53	75.4	3.11	
Leitchfield†	91	54	75.0	4.34	
Loretto	95	49	74.5	5.01	
Lyndon				5.00	
Maysville	98	45	75.2	3.72	
Middlesboro†	98	51	74.2	2.96	
Mount Hermon	93	55	75.3	4.75	
Mount Sterling†	97	52	74.8	4.56	
Owensboro†	93	56	77.0	2.21	
Owenton†	92[f]	57[f]	74.8[f]	3.35	
Paducah *a*†				4.15	
Paducah *b*†	97	62	80.8	4.81	
Princeton	96	57	78.2	3.74	
Richmond†	98	52	75.3	3.35	
Russellville†	98	55	78.8	4.09	
St. John†	92	52	73.7	5.05	
Scott	91	48	73.9	3.50	
Shelby City	100	48	74.7	1.91	
Shelbyville†	101	49	77.0	5.80	
Vanceburg	94	45	72.2	4.80	
Williamsburg†	97	54	77.2	1.55	
Woodburn*[1]				3.90	
Louisiana.					
Abbeville	91	66	78.7	11.00	
Alexandria†	96	64	78.2	6.86	
Amite†	98	66	81.2	6.52	
Bastrop†	97	67	81.0	9.64	
Baton Rouge†	95	66	80.0	8.42	
Calhoun	94	66	79.6	8.61	
Cheneyville†	95	65	80.7	6.16	
Clinton†	94	64	79.3	7.49	
Como	95	68	80.2	5.31	
Covington	96	67	80.5	7.21	
Donaldsonville	94	67	80.3	9.89	
Elm Hall	94	60	78.6	9.80	
Emilie	90	66	78.2	3.07	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Farmerville	92	68	80.0	9.05	
Franklin†	97	68	82.5	9.85	
Grand Coteau	95	68	79.4	12.04	
Houma*	95	65	81.0	7.63	
Jeanerette	96	66	75.3	12.35	
Jennings	96	61	77.6	5.84	
Lafayette	95	63	79.6	13.01	
Lake Charles†	95	66	80.4	3.85	
Lawrence	93			4.93	
Liberty Hill	98	64	81.2	4.46	
Mansfield	95	65	79.3	9.87	
Melville				3.84	
Minden	97	63	80.3	6.81	
Monroe†	95	66	80.0	7.30	
Montgomery	98	65	81.3	5.46	
New Iberia	92	68	79.8	13.10	
Oakridge	97	65	80.9	13.05	
Opelousas	96	60	79.0	6.16	
Oxford *b*	94	64	79.5	4.64	
Paincourtville†	95	68	80.1	7.23	
Plain Dealing†	95	64	79.2	14.56	
Plaquemine	100	65	81.6	8.23	
Rayne	97	65	80.1	11.90	
Robeline	95	61	78.2	4.93	
Ruston	89	67°	77.6	13.26	
Schriever	98	64	80.4	9.54	
Shellbeach	92	70	81.4	6.73	
Southern University†	92	68	78.6	4.72	
Sugar Ex. Station†	93	69	81.4	4.47	
Sugartown	91	64	79.5	6.65	
Venice†	90	68	80.1	5.24	
Wallace	92	68	80.5	4.14	
White Sulphur Springs.	98	65	79.8	9.40	
Maine.					
Bar Harbor	86	42	60.3	3.27	
Belfast*[6]	83	52	60.2	4.69	
Calais	86	38	61.0	4.48	
Cornish*[1]	85	51	64.6	3.28	
Cumberland Mills	91	44	64.0	4.57	
Fairfield	87	41	63.2	3.32	
Farmington	86	37	62.8	4.34	
Flagstaff	83	31	59.7	2.45	
Gardiner	90	42	64.5	3.56	
Lewiston	90	45	64.4	4.85	
Mayfield*[1]	84	40	61.2	2.94	
North Bridgton	87	43	64.2	4.19	
Orono	87	36	61.1	5.28	
Petit Menan*[1]	70	45	54.6		
Winslow	88	38	63.1	3.42	
Maryland.					
Annapolis	95	53	76.8	0.88	
Bachmans Valley	100	41	70.2	0.86	
Boettcherville	98	44	71.2	1.90	
Charlotte Hall†	98	48	73.0	1.76	
Cherryfields†[2]			72.4	2.95	
Chestertown	91	50	71.0	1.17	
Collegepark	98	48	73.8	0.35	
Cumberland *b*	92	51	73.0	1.66	
Darlington†	93	50	71.1	1.62	
Deerpark	88	35	63.9	3.36	
Denton*	98	52	76.0	1.83	
Easton†	96	51	72.3	1.47	
Ellicott City	96	48	71.1	1.60	
Fallston	92	48	69.8	1.82	
Frederick	99	47	73.1	0.74	
Grantsville	88	40	65.5	3.07	
Greatfalls	97	47	72.2		
Greenspring Furnace	97	48	72.8	0.76	
Hancock	93	46°	72.4°	2.77	
Jewell†	95	49	71.1	2.57	
Johns Hopkins Hospital	99	52	72.6	1.16	
Kensington	97	47	72.8	0.78	
Laurel	99	47	72.0	0.65	
Mardela Springs† [k]	91	49	69.6	3.23	
Mount St. Marys Coll.†	96	52	71.6	1.95	
New Market	99	45	73.6	0.63	
Pocomoke City	98	53	73.4	2.38	
Princess Anne	93	50	70.5	3.87	
Sharpsburg	96	46	71.0	1.23	
Smithsburg	97	42	71.0	0.58	
Solomons†	96	55	74.0	1.72	
Sunnyside	87	36	64.4	2.33	
Taneytown†	98	46	72.8	1.22	
Van Bibber	95	52	72.2	1.30	
Westernport	100	41	73.2	2.18	
Westminster	97	50	71.2		
Woodstock	95	50	72.8	1.80	
Massachusetts.					
Adams	88	42	66.0		
Amherst	90	39	66.2	3.23	
Attleboro				2.18	
Bedford	88	42	64.2	2.91	
Bluehill (summit)	88	46	63.9	2.70	
Cambridge *a*	90	42	66.6	1.66	
Chestnut Hill	91	42	67.0	2.36	
Cohasset				1.54	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Concord	91	38	64.9	2.36	
Dudley[1]	87*	48	66.6	4.15	
East Templeton*[1]	88	48	65.3	3.74	
Fallriver	88	48	66.1	0.88	
Fiskdale				2.70	
Fitchburg *a**[1]	88	52	65.8	3.58	
Fitchburg *b*	89	40	65.9	3.06	
Framingham	92	41	66.8	2.24	
Groton	89	38	64.7	3.10	
Hyannis*†[1]	84	45	61.3	1.22	
Jefferson				3.38	
Lawrence	91	45	66.3	2.68	
Leeds	92	40	66.7	4.77	
Leicester Hill	88	44	66.4	2.63	
Leominster				2.69	
Long Plain				1.13	
Lowell *a*	89	43	66.7	3.65	
Lowell *b*	91	41	65.3		
Ludlow	83	40	62.0	3.00	
Lynn *a*	90	45	65.0	1.53	
Mansfield*[1]	88	45	63.7	1.76	
Middleboro	87	39	61.8	1.74	
Monson	90	38	66.7	3.33	
New Bedford *a*	86	45	63.6	0.94	
New Bedford *b*	87	43	63.9	1.40	
New Salem	84	43	64.2	3.93	
Pittsfield	87	53	65.8	7.36	
Plymouth*[1]	90	52°	65.6°	1.70	
Princeton				3.02	
Somerset*[1]	96	46	68.5	1.04	
Springfield Armory	91	38	65.8	3.26	
Sterling				3.11	
Taunton *c*	87	37	64.6	1.55	
Turners Falls	90	41	66.6	2.73	
Webster				3.07	
Westboro†	90	38	67.2	3.15	
Weston	88	38	65.0	1.78	
Williamstown	86	44	65.1	3.01	
Winchendon				4.44	
Michigan.					
Adrian	91	44	68.5	5.24	
Agricultural College	92	43	67.6	4.91	
Allegan	96	42	69.2	3.12	
Alma	94	42	68.7	2.84	
Ann Arbor	93	44	69.2	2.82	
Arbela	93	41	68.4	5.16	
Badaxe	92	43	66.5	3.28	
Baldwin	92	31	66.2	1.27	
Ball Mountain	92	43	67.2	1.99	
Baraga	90	35	57.5	5.17	
Battlecreek	93	44	70.4	4.12	
Bay City *b*	92	44	66.5	4.53	
Berlin	91	39	66.7	2.89	
Berrien Springs	95	38	68.8	2.22	
Big Point Sable*[16]	77	46	59.8		
Big Rapids	88	38	66.4	1.98	
Birmingham	95	45	71.1	2.16	
Bois Blanc*[10]	86	42	58.8		
Boon	89	36[d]	64.0	2.61	
Calumet	87	40	57.4	6.43	
Camden	94	42	69.8	3.63	
Carsonville	92	38	65.6	3.04	
Charlevoix	92	44	62.4	7.26	
Cheboygan	94	39	61.2	4.36	
Clinton	93	43	69.9	3.46	
Coldwater	91	43	68.4	3.44	
Crisps*[10]	90	39	57.9		
East Tawas	91	45	65.0	3.66	
Eloise	93	45	68.8	3.23	
Escanaba†	86	38	61.7	3.82	
Ewen	90	30	60.8		
Fairview	90	44	67.0	1.98	
Fitchburg	94	39	67.7	3.57	
Flint	94	41	67.2	2.56	
Gladwin	94	38	66.3		
Grand Rapids *b*	93	40	69.6	2.04	
Grape	93	44	69.8	1.80	
Grayling	95	36	66.0	3.10	
Hammonds Bay*[10]	92	48	60.2		
Hanover	91	38	67.8	2.84	
Harrisville	95	41	62.7	6.59	
Hart	89	37	67.2	0.80	
Hastings	94	40	69.2	2.66	
Hayes	91	38	63.9	3.27	
Highland Station				2.83	
Hillsdale	91	43	68.8	2.90	
Holland*[10]	84	45	67.0		
Howell	92	42	70.4	1.52	
Humboldt	88	30	59.0	4.89	
Ionia	96	41	68.0	3.45	
Iron River	86	27	60.4	5.42	
Ivan	92	38	66.6	3.80	
Jackson	95	44	70.6	2.87	
Jeddo	91	41	65.8	3.63	
Kalamazoo	93°	46°	70.0°	3.55	
Lake City	90	35	65.2	6.15	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lansing	93	43	68.5	4.48	
Lapeer	92	40	67.2	3.36	
Lathrop	90	30	60.0	6.02	
Ludington	83	40	63.4	1.18	
Luzerne	93	36	64.8	5.68	
Mackinaw City	92	40	58.4	5.42	
Madison	95	45	70.5	3.19	
Mancelona	93	35	65.6	5.36	
Manistee	89	36	62.7	2.93	
Manistique	80	40	58.1	4.82	
Middle Island *10	86	49	60.4	.....	
Midland	94	49	68.0	2.90	
Mottville	94	42	69.4	2.53	
Mount Clemens	95	42	68.1	3.86	
Mount Pleasant *b*	92	42	67.2	4.04	
Muskallongee Lake *10	93	41	55.5	.....	
Muskegon	86	43	65.6	1.98	
Newberry	86	30	58.0	3.63	
North Manitou Island *10	81	45	62.4	.....	
North Marshall	92	38	67.0	4.76	
Northport	90[b]	42[b]	62.7[c]	3.85	
Old Mission	92	42	64.0	3.71	
Olivet	89	44	69.0	4.00	
Omer	94	35	63.4[c]	1.65	
Ottawa Point *10	88	49	63.6	.....	
Ovid	94	40	68.2	3.76	
Owosso	94	42	70.1	3.87	
Parkville	.....	.....	.....	3.14	
Pentwater *10	86	50	64.4	.....	
Petoskey	93[c]	39[c]	60.2[c]	6.12	
Plymouth	95	39	67.3	2.16	
Pointe aux Barques *10	88	49	65.0	.....	
Point Betsey *10	74	50	60.9	.....	
Port Austin	92	41	64.8	7.53	
Powers	92	33	63.8	.....	
Reed City	91	35	65.4	.....	
Rockland [1]	87	42[b]	59.9	0.29	
Rogers	96	41	60.0	4.59	
Romeo	92	45	93.3	4.48	
Saginaw	94	42	69.3	4.59	
St. Ignace	86	42	59.6	4.36	
St. Johns	91	43	69.4	3.17	
St. Joseph	91	48	69.4	2.69	
Sandbeach *a*	92	40	63.4	4.19	
Sidnaw	90	30	60.7	.....	
Somerset	91	42[b]	67.8[d]	1.12	
South Haven	90	41[c]	68.1	2.25	
Stanton	92	36	68.5	.....	
Sturgeon Point *10	90	40	62.1	.....	
Thomaston	90	30	61.2	2.56	
Thornville	91	46	69.8	3.30	
Thunder Bay Island *10	81	42	60.4	.....	
Traverse City	93	42	62.7	3.42	
Two Heart River *10	94	40	56.3	.....	
Valley Center	92	35	64.8	1.85	
Vandalia	91	45	69.4	3.64	
Vassar	93	41	67.1	3.42	
Vermillion Point *10	84	35	51.4	.....	
Wasepi	91	44	68.7	3.19	
Waverly	91	38	67.2	3.00	
West Harrisville	90	40	62.4	7.29	
Wetmore	87	29	56.5	5.23	
White Cloud	91	37	68.1	1.42	
Williamston	93	42	68.4	2.84	
Ypsilanti	90	45	67.8	3.67	
Minnesota.					
Ada †	98[b]	37[b]	65.4[b]	4.48[c]	
Albert Lea	89	46	66.8	4.10	
Alexandria †	93	45	66.1	4.51	
Beardsley	99	39	66.0	3.24	
Bingham Lake	93	41	68.4	2.45	
Bird Island	93	43	66.9	2.12	
Blooming Prairie †	92	43	67.5	3.60	
Caledonia †	89	46	67.8	3.92	
Camden	95	42	68.2	3.71	
Campbell	96	38	64.0	1.07	
Collegeville	90	45	67.2	3.14	
Crookston †	88	37	62.1	5.83	
Deephaven	.....	.....	.....	3.01	
Detroit City	93	39	62.4	2.52	
Faribault	90	47	67.2	5.00	
Farmington †	96	38	65.4	3.63	
Fergus Falls †	94	40	65.5	3.40	
Glencoe	90	32	65.8	1.87	
Grand Meadow †	94	45	68.2	4.78	
Granite Falls	95	41	66.0	1.39	
Koochiching	86	34	59.7	7.73	
Lake City	98	43	69.6	2.24	
Lake Jennie	91	46	68.3	3.12	
Lakeside †	91	47	67.4	3.43	
Lake Winnibigoshish	91	40	62.4	5.62	
Leech Lake	95	39	64.0	4.54	
Long Prairie	92	39	66.4	2.59	
Lutsen	76	37	53.6	6.23	
Luverne †	89	48	68.4	4.82	
Lynd	92	41	66.2	3.30	
Mapleplain	.....	.....	.....	2.96	
Maplewood *1	90	54	69.6	.....	
Milaca	94	41	64.8	1.97	
Milan †	95	43	66.5	3.12	
Minneapolis *a*	93	46	68.2	4.82	
Minneapolis *b* [1]	93*	43	67.0	2.85	
Minnesota City †	.....	.....	.....	2.72	
Morris	94	44	67.2	3.01	
Mount Iron	92	33	60.8	8.28	
Newfolden	89	34	61.2	5.27	
New London	96	46	69.0	2.48	
New Richland *d* *1	94	52	67.8	.....	
New Ulm †	93	46	68.4	3.74	
Park Rapids †	92	41	63.1	4.17	
Pine River	90	43	63.8	11.39	
Pipestone	.....	.....	.....	3.31	
Pleasant Mounds	88	46	66.6	4.51	
Pokegama Falls	90	33	61.7	5.57	
Redwing	.....	.....	.....	2.07	
Reeds	.....	.....	.....	1.99	
Rolling Green	90	48	67.4	2.60	
St. Charles †	94	44	68.0	3.40	
St. Cloud	92	45	66.4	3.73	
St. Olaf	92	44	65.6	1.94	
St. Peter	.....	.....	.....	5.05	
Sandy Lake Dam	89	34	61.8	4.72	
Sauk Center	92	44	72.6	2.65	
Shakopee	92	47	70.2	2.68	
Tower †	97	.....	.....	7.50	
Two Harbors	84	36	55.0	6.45	
Wabasha *1	97	53	69.1	3.08	
Willmar	91	43	66.7	2.70	
Willow River	92	38	63.6	4.70	
Winnebago City	97	46	68.1	6.42	
Worthington	90	46	68.8	3.66	
Zumbrota [1]	91*	42	69.1	.....	
Mississippi.					
Aberdeen	102	64	81.3	3.20	
Agricultural College	95	61	77.8	2.46	
Austin †	94	65	80.1	2.38	
Batesville †	95	63	79.2	3.88	
Bay St. Louis	90	70	81.0	4.44	
Biloxi †	91	70	80.4	4.89	
Booneville	95	64	80.3	1.19	
Briers	90	68	78.4	7.08	
Brookhaven †	100	62	81.2	4.26	
Canton †	96	64	79.6	5.56	
Columbus *a*	.....	.....	.....	3.27	
Columbus *b*	102	67	83.4	3.12	
Corinth	95	60	79.7	2.42	
Crystal Springs †	96	66	81.3	6.02	
Edwards	97	68	81.9	9.06	
Fayette	95	62	79.5	10.75	
French Camps *b*	95	62	77.0	3.38	
Greenville *a*	92	69	79.6	2.40	
Greenville *b* †	93	68	80.6	2.54	
Greenwood	93	62	79.3	6.61	
Hattiesburg †	98	68	82.5	4.80	
Hazlehurst	97	66	80.5	8.74	
Hernando	94	66	80.2	2.63	
Holly Springs †	96	67	80.1	3.11	
Jackson †	97	61	81.2	5.72	
Lake †	95	64	79.4	6.09	
Leakesville	100	60	80.8	.....	
Logtown †	95	68	81.5	2.69	
Louisville †	95	63	78.9	3.35	
Macon †	101	61	82.7	3.20	
Magnolia †	94	64	78.8	10.08	
Meridian	98	62	80.7	3.48	
Moss Point	95	69	81.9	3.90	
Natchez †	95	65	80.5	8.30	
Okolona †	99	62	81.9	2.97	
Palo Alto	94	68	80.6	5.47	
Pontotoc	95	62	78.8	1.62	
Port Gibson †	96	66	80.4	8.46	
Rosedale *	95	67	77.8	1.18	
Stonington *1	90	68	76.7	.....	
Thornton	.....	.....	.....	6.51	
Tupelo †	.....	.....	.....	2.04	
Walnut Grove	.....	.....	.....	5.07	
Water Valley *† [1]	96	61	77.5	5.91	
Waynesboro	98	60	81.0	6.85	
Windham	99	63	82.6	8.14	
Woodville †	.....	67	.....	6.58	
Yazoo City †	99	67	82.8	6.64	
Missouri.					
Akron	.....	.....	.....	5.21	
Appleton City	95	51	76.4	9.79	
Arlington	.....	.....	.....	4.33	
Arthur *2	.....	65	74.8	11.08	
Avalon	92	58	74.4	7.26	
Bagnell	.....	.....	.....	5.60	
Bethany	93	56	74.7	6.07	
Birchtree	89	57	74.0	3.95	
Bolckow	.....	.....	.....	6.50	
Boonville †	.....	.....	.....	7.67	
Brunswick	91	60	74.8	9.88	
Carrollton †	93	62	76.0	4.68	
Conception	90	60	73.3	6.59	
Cowgill *5	88	60	74.8	7.79	
Darksville	92	56	74.4	8.30	
Downing	.....	.....	.....	2.42	
East Lynne *3	.....	58	72.0	6.26	
Edgehill *5	90	56	74.8	4.71	
Eightmile *1	88	58	72.0	5.83	
Eldon	.....	58	.....	4.03	
Elmira	95	53	73.6	6.66	
Fairport	.....	.....	.....	10.71	
Farmersville	.....	.....	.....	8.64	
Fayette	97	60	78.7	8.86	
Fulton	.....	.....	.....	7.21	
Gallatin *1	92	58	74.7	10.10	
Glasgow	94	56	75.8	5.28	
Gordonville *3	.....	66	73.1	5.79	
Gorin	.....	.....	.....	3.74	
Halfway	90	56	74.8	6.16	
Harrisonville †	94	59	75.2	7.49	
Hermann †	.....	.....	.....	5.85	
Houston	94	58	75.4	3.10	
Houstonia	.....	.....	.....	5.84	
Irena	.....	.....	.....	5.25	
Ironton †	94	49	75.0	6.18	
Jefferson City †	100	57	76.9	5.63	
Kidder	93	58	73.5	10.58	
Lamar †	96	60	77.2	7.55	
Lamonte	.....	.....	.....	4.93	
Lebanon	89	61	74.6	7.81	
Lexington	93	55	76.0	4.56	
Liberty	92	56	75.2	4.70	
Louisiana	93	53	75.0	7.15	
McCune *† [1]	90	62	74.8	6.50	
Malden	98	61	79.6	5.77	
Mansfield	.....	.....	.....	4.30	
Marblehill	92	54	74.8	4.87	
Marshall †	92	57	75.0	5.34	
Maryville	95	56	74.0	4.89	
Mexico †	95	55	75.8	6.52	
Mineralspring	89	57	73.2	5.40	
Montreal	90	55	74.4	6.56	
Mount Vernon	94	60	77.0	5.12	
Neosho	91	59	75.8	4.73	
Nevada	90	56	74.6	6.63	
New Haven	92	58	76.3	4.32	
New Madrid	97	62	79.3	6.23	
New Palestine	95	64	75.6	7.57	
Oakfield	94	59	77.5	6.20	
Oakmound	.....	.....	.....	3.04	
Olden †	89	58	73.8	4.11	
Oregon *a*	93	60	74.5	4.61	
Oregon *b*	94	59	76.1	4.10	
Osceola †	.....	.....	.....	9.35	
Palmyra *5	92	60	79.6	3.85	
Phillipsburg *† [1]	92	66	74.5	7.94	
Pickering *3	.....	54	71.0	3.74	
Platte River	92	57	74.4	6.81	
Potosi	94	42	70.6	8.22	
Princeton	99	59	76.8	4.28	
Rhineland	93	52	75.2	4.85	
Richmond	92	58	74.2	6.41	
Rolla	.....	.....	.....	3.02	
St. Charles	92	57	76.1	8.59	
St. Joseph	.....	.....	.....	8.61	
Sarcoxie *3	94	62	75.2	5.14	
Sedalia	93	60	76.1	9.14	
Seymour	88	58	73.3	3.39	
Shelbina	.....	.....	.....	5.10	
Sikeston	95[b]	53	76.2[f]	3.45	
Steffenville	92	56	74.2	3.29	
Stellada †	91	58	76.2	7.24	
Sublett	93	52	73.8	3.15	
Unionville	96	57	77.4	6.02	
Vichy	96	56	76.4	7.95	
Warrenton	94	53	75.7	5.45	
Wheatland	.....	.....	.....	8.10	
Willow Springs	97	55	75.2	5.36	
Zeitonia	93	54	76.4	4.30	
Montana.					
Adel	81	28	52.4	3.71	
Billings	93	41	62.9	4.59	
Boulder	89	32	57.0	1.83	
Bozeman †	90	33	59.6	3.18	
Butte	87[d]	35[d]	57.2[d]	3.06	
Castle	87	30	52.6	4.75	0.4
Chinook †	95	34	60.0	2.65	
Columbia Falls	87	32	57.9	1.08	
Crow Agency	96	38	64.6	2.58	
Dearborn Canyon	88	36	56.2	4.56	
Dupuyer	88	30	56.6	0.25	1.0
Fort Benton	92	37	60.1	4.87	
Fort Keogh †	102	45	65.8	1.64	1.0
Fort Logan	89	32	55.6	3.23	
Glasgow	97	30	61.2	2.37	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Glendive †	103	45	66.2	5.70	
Glenwood	92	34	57.3	3.17	
Greatfalls †	89	39	60.8	2.93	
Kipp †	88	29	55.5	1.59	T.
Lewistown	90	32	57.0	5.11	
Livingston †	94	36	58.1	4.28	
Manhattan †	89[x]	33[x]	57.9[x]	3.05	
Martinsdale †	88	33	56.2	4.63	
Marysville †	83	35	54.6	4.22	T.
Parrot	93	36	60.0	4.25	
Poplar	99	42	64.0	2.78	
Redlodge	88	33	55.2	4.17	
St. Ignatius Mission	80	37	59.6	1.13	
St. Pauls †	90	32	58.8	2.70	
Troy	91	34	59.6	1.56	
Utica	90	34	56.4	5.80	
Wibaux	84	37	62.7	6.79	
Yale	87	34	56.9	3.61	
Nebraska.					
Agee *1	96	53	69.5	2.51	
Albion	92	48	69.7	4.62	
Alliance	.....	.....	.....	1.10	
Alma *1	98	56	72.2	4.49	
Ansley †	96	41	68.8	3.49	
Arapaho *1	97	50	71.0	3.23	
Arborville *1	95	54	71.3	6.44	
Ashland *a* †	98	51	73.8	2.21	
Ashland *b* *1	105	63	77.2	1.96	
Ashton	96	50	70.3	4.45	
Auburn *† 1	96	56	73.9	4.94	
Aurora	.....	.....	.....	8.45	
Beatrice †	97[d]	57[c]	74.0[d]	1.64	
Beaver City †	102	49	71.4	3.73	
Bellevue	.....	.....	.....	4.49	
Benedict	.....	.....	.....	4.91	
Benkelman	.....	.....	.....	3.26	
Blair	95	51	71.2	3.58	
Bluehill	.....	.....	.....	3.75	
Brokenbow	.....	.....	.....	2.49	
Burchard	.....	.....	.....	3.95	
Burwell	.....	.....	.....	2.68	
Callaway †	96	40	69.1	2.98	
Camp Clarke	102	33	69.0	1.68	
Central City *5	96	52	75.0	5.15	
Cody	.....	.....	.....	0.60	
Columbus †	94	49	70.9	5.09	
Cornlea	.....	.....	.....	5.07	
Creighton †	99	44	70.4	5.11	
Crete	94	51	73.0	3.92	
Culbertson	.....	.....	.....	3.48	
Curtis *a*	99	45	70.2	3.27	
David City	93	52	70.8	5.30	
Dawson	92	55	75.8	4.99	
Divide	.....	.....	.....	3.81	
Dunning	.....	.....	.....	1.07	
Eden	.....	.....	.....	5.90	
Edgar *1	94	46	67.4	4.65	
Elba	.....	.....	.....	6.05	
Ericson *† 1	98	55	75.4	2.48	
Ewing †	.....	.....	.....	2.42	
Fairbury †	97	82	73.2	3.07	
Fairfield	.....	.....	.....	3.59	
Fairmont †	95	50	70.9	8.75	
Fort Robinson	99	35	64.8	2.09	
Franklin	.....	.....	.....	3.59	
Fremont †	97	50	72.1	6.72	
Geneva †	96	50	72.9	11.62	
Genoa	94	49	71.0	3.91	
Gering	.....	.....	.....	1.38	
Gordon	.....	.....	.....	1.06	
Gothenburg	102	44	71.6	4.02	
Grand Island *b*	93	49	70.3	4.73	
Greeley	.....	.....	.....	6.12	
Haigler	.....	.....	.....	4.18	
Hartington †	97	47	69.2	6.03	
Harvard	90	52	70.6	6.02	
Hastings *1	94	57	70.9	3.00	
Hayes Center	.....	.....	.....	3.85	
Hay Springs	98	36	66.5	0.43	
Hebron †	98	52	73.0	6.11	
Hickman	.....	.....	.....	2.51	
Holdrege *b*	.....	.....	.....	3.85	
Hooper *1	94	57	72.0	6.31	
Imperial †	102	40	70.8	3.55	
Johnstown	.....	.....	.....	2.05	
Kearney	.....	.....	.....	4.18	
Kennedy	104	43	67.4	1.91	
Kimball †	99	35	67.3	2.61	
Kirkwood *1	97	52	68.9	3.30	
Lexington †	92	43	68.8	4.36	
Lincoln *b*	94	54	73.2	4.86	
Lincoln *d* †	95	52	72.5	4.28	
Lodgepole †	104	39	68.1	T.	
Loup *b* *1	96	52	69.1	3.91	
Lynch *† 1	98	40	69.0	1.91	
Lyons	.....	.....	.....	6.23	
McCook	.....	.....	.....	3.70	
McCool	.....	.....	.....	5.23	
Madison	92	44	70.9	6.06	
Madrid *5	105	45	69.4	1.78	
Marquette	.....	.....	.....	6.46	
Merriman	.....	.....	.....	0.40	
Minden *a*	96	48	70.6	4.44	
Minden *b*	.....	.....	.....	4.11	
Monroe	.....	.....	.....	4.39	
Nebraska City *b*	.....	.....	.....	2.31	
Nebraska City *c*	99	51	73.9	2.77	
Nemaha *1	100	62	67.4	5.18	
Nesbit	96	46	67.8	4.23	
Norfolk *b*	94	48	70.2	6.04	
North Loup	96	48	68.7	4.43	
Oakdale †	96	47	70.5	4.82	
Odell *5	93	62	73.8	4.03	
O'Neill †	93	44	66.9	2.82	
Ord	96	44	69.7	2.31	
Osceola	.....	.....	.....	5.06	
Ough †	.....	.....	.....	3.24	
Palmer *b*	.....	.....	.....	8.12	
Plattsmouth *a*	.....	.....	.....	4.17	
Ravenna *a*	94	46	70.0	3.25	
Redcloud *a*	.....	.....	.....	3.05	
Redcloud *b* *1	94	58	72.4	1.30	
Republican *1	96	54	74.6	4.00	
Rulo *1	99	64	76.4	5.14	
St. Libory	96	50	71.6	5.36	
St. Paul	94	52	72.4	7.16	
Salem *1	94	60	74.5	5.65	
Santee Agency †	98	46	71.9	2.41	
Schuyler	.....	.....	.....	7.01	
Seneca *1	100	44	69.2	0.20	
Seward *1	94	59	73.2	4.97	
Springview	.....	.....	.....	2.90	
Stanton	.....	.....	.....	6.08	
Stockham	.....	.....	.....	4.30	
Strang *1	94	60	74.4	9.37	
Stratton	.....	.....	.....	2.86	
Superior *5	98	60	75.6	3.79	
Syracuse	.....	.....	.....	3.22	
Tablerock	100	56	77.2	5.35	
Tecumseh *b* †	99	49	75.3	2.49	
Tekamah	97	50	72.8	4.72	
Thedford *1	96	42	69.6	6.10	
Turlington †	94	50	70.6	2.79	
Valentine †	98	40	67.8	2.11	
Valparaiso	.....	.....	.....	5.04	
Wakefield	95	48	70.3	6.78	
Wallace	.....	.....	.....	2.26	
Wauneta	.....	.....	.....	3.25	
Weeping Water *1	95	54	71.1	3.67	
Westpoint †	95	48	73.0	6.24	
Wilber *1	92	60	76.4	5.27	
Willard	.....	.....	.....	3.05	
Wilsonville *1	97	54	74.6	4.05	
Wisner	.....	.....	.....	6.91	
Wymore *1	98	60	72.0	2.51	
York *1	98	58	72.0	4.76	
Nevada.					
Austin	86	31	64.6	0.05	
Battle Mountain *1	89	40	64.1	0.00	
Beowawe *1	84	40	64.2	T.	
Blaine	85	26	57.2	T.	
Candelaria	98	39	68.0	T.	
Carlin *1	96	34	59.4	0.00	
Carson City	90	30	60.6	T.	
Clover Valley	.....	.....	.....	0.67	
Cranes Ranch	.....	.....	.....	0.16	
Elko *1	95	42	63.7	0.15	
Ely	95	24	61.4	0.15	
Empire Ranch	100	36	72.6	0.02	
Fenelon *1	86	32	59.2	0.45	
Golconda *1	90	38	62.5	0.00	
Halleck *1	99	35	64.6	T.	
Hawthorne *a* *1	91	47	71.8	0.00	
Hawthorne *b*	95	41	68.0	0.00	
Hot Springs	.....	.....	.....	0.00	
Humboldt *1	92	40	65.0	T.	
Lewers Ranch	87	29	60.8	0.23	
Los Vegas	98	52	71.6	0.20	
Lovelocks	.....	.....	.....	T.	
McGill	96	21	60.9	0.00	
Martins	87	32	61.4	0.00	
Midas	89	29	62.2	0.10	
Mill City *1	100	42	70.8	0.00	
Monitor Mill	91	20	60.3	0.11	T.
Palisade *1	98	45	68.0	0.00	
Palmetto	94	26	62.0	0.20	
Panaca	104	35	69.9	0.05	
Reno *1	103	41	71.6	T.	
Reno State University	90[i]	33	61.7[e]	0.00	
Ruby Valley	.....	.....	.....	0.24	T.
St. Clair	91	36	66.0	0.00	
Silverpeak	103	43	73.8	T.	
Nevada—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sodaville	100	41	70.7	0.00	
Tecoma	.....	.....	.....	2.00	
Toano *1	92	38	65.0	2.38	T.
Tuscarora	85	18	50.5	0.57	
Tybo	98	34	66.6	T.	
Verdi *1	95	32	64.8	0.35	
Wadsworth *1	94	40	69.0	0.00	
Wells	93	21	60.6	0.26	
New Hampshire.					
Alstead *5	82	44	67.6	3.05	
Berlin Mills	87	34	61.0	5.30	
Bethlehem	84	39	63.0	5.10	
Brookline *1	90	50	66.5	4.49	
Claremont [d]	89	36	67.0	1.66	
Concord	89	35	65.6	3.10	
Durham	90	38	64.2	2.44	
Hanover	87	38	66.0	4.30	
Keene	90	35	65.2	3.41	
Lancaster	.....	.....	.....	3.89	
Littleton	83	40	63.4	5.86	
Nashua	92	44	66.2	3.25	
Newton	90	35	63.7	3.46	
North Conway	89	32	64.4	3.60	
Peterboro	87	33	63.9	3.69	
Plymouth	90	35	64.9	2.92	
Sanbornton †	86	36	63.1	4.08	
Stratford	87	34	62.8	3.97	
Warner	.....	.....	.....	3.99	
New Jersey.					
Asbury Park	96	50	69.0	1.73	
Bayonne	95	51	71.2	1.88	
Belvidere	93	43	70.4	2.29	
Bergen Point	92	51	70.6	1.86	
Beverly †	96	47	72.8	1.66	
Billingsport *1	93	60	71.8	3.54	
Boonton	94	48	70.8	2.13	
Bridgeton	96	50	73.8	3.24	
Camden	92	51	71.0	1.56	
Cape May C. H. †	92	47	68.3	2.30	
Charlotteburg	88	38	66.0	2.12	
Chester	92	43	68.2	2.08	
Clayton	95	48	71.0	1.74	
College Farm †	94	47	70.9	1.13	
Deckertown	92	41	68.6	2.52	
Dover	94	42	69.5	1.29	
Egg Harbor City	96	45	69.4	2.58	
Elizabeth †	97	48	71.6	1.96	
Englewood	95	44	69.1	1.35	
Flemington	94	45	71.2	1.85	
Franklin Furnace	90	42	67.5	2.89	
Freehold	92	46	68.8	1.29	
Friesburg	96	47	70.8	1.80	
Gillette	93	45	69.0	1.65	
Hammonton	.....	.....	.....	1.77	
Hanover	90	45	69.0	3.39	
Hightstown	95	49	71.6	1.60	
Imlaystown	96	46	72.4	1.38	
Junction	.....	.....	.....	2.76	
Lambertville	97	45	73.4	0.96	
Moorestown	94	48	71.2	1.86	
Newark *b* †	95	52	71.2	2.12	
New Brunswick *a*	96	47	73.2	1.24	
Newton	92	46	69.4	2.13	
Ocean City	93	48	67.4	2.95	
Oceanic	95	52	69.4	1.87	
Paterson	96	50	71.5	2.34	
Plainfield	94	44	69.8	2.27	
Rancocas	.....	.....	.....	2.08	
Rivervale	97	42	68.8	1.24	
Roseland	91	43	68.4	3.36	
Salem	95	51	72.0	1.84	
Somerville	95	45	71.2	2.14	
South Orange	91	51	70.2	2.43	
Staffordville	.....	.....	.....	1.78	
Toms River	96	43	68.4	2.56	
Trenton	95	50	73.1	1.62	
Tuckerton	94	46	69.6	1.83	
Vineland	100	47	71.3	2.59	
Woodbine	93	45[j]	68.1[e]	2.34	
New Mexico.					
Albert	106	46	74.5	2.35	
Albuquerque †	104[j]	48[j]	78.8[j]	1.00	
Alma	95	39	69.3	0.85	
Aztec †	96	34	68.2	1.19	
Bernalillo †	99	45	72.4	0.41	
Bluewater	99	29	66.2	0.90	
Buckmans	92	23	56.6	1.98	
Clayton	96	48	69.4	3.15	
Deming *1	98	52	75.3	T.	
East Lasvegas †	92	42	65.2	2.74	
Eddy	101	54	74.2	5.51	
Engle †	99	45	73.6	1.78	
Espanola	100	40	68.5	0.56	
Folsom	92	41	65.3	2.67	
Fort Bayard	93	43	68.0	2.37	
Fort Union	99	37	64.4	3.20	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
New Mexico—Cont'd.					
Fort Wingate	100	37	67.3	1.78	
Gallisteo	95	43	67.6	1.36	
Gallinas Spring†	101	48	72.2	1.82	
Gila	102	45	74.8	1.39	
Laluz	96	47	75.6	3.13	
Las Cruces †	100	42	72.3	1.83	
Las Vegas Hotsprings	98	42	64.4	3.10	
Lordsburg *[1]	100	62	79.1	0.33	
Lower Penasco	99	48	70.8	1.80	
Ollo	103	33	70.0	0.05	
Puerto de Luna	101	51	74.4	2.04	
Raton	95	38	65.7	.....	
Rincon†	100	43	75.0	1.55	
Roswell †	99	48	72.1	6.05	
San Marcial	100	49	73.8	1.42	
White Oaks †	95	40	66.7	5.21	
Winsors Ranch	86	25	54.2	2.35	
New York.					
Adams	.....	.....	.....	2.15	
Addison	90	38	66.8	3.67	
Akron	.....	.....	.....	2.25	
Alden	85	39	64.8	2.34	
Alfred	86	32	64.8	3.80	
Angelica †	87	35	65.6	5.28	
Appleton	91	42	66.6	3.35	
Arcade	85	39	64.6	6.17	
Atlanta	.....	.....	.....	4.29	
Auburn	91	42	68.6	3.72	
Avon	90	40	67.4	3.73	
Bedford	91	42	67.1	1.43	
Big Sandy *[2]	83	46	66.0	.....	
Bolivar	87	32	63.8	5.12	
Bouckville	86	39	64.8	2.57	
Boyds Corners	.....	.....	.....	1.50	
Brentwood	92	41	68.1	0.70	
Canajoharie	90	43	69.3	2.55	
Canton	88	41	66.4	3.93	
Carmel	90	48	69.5	1.23	
Carvers Falls	86	38	65.1	3.57	
Catskill	91	46	68.4	3.30	
Cedarhill	94	45	69.0	4.16	
Charlotte *[10]	86	43	61.9	.....	
Chenango Forks	.....	.....	.....	2.75	
Cherry Creek	.....	.....	.....	5.51	
Cooperstown †	87	44	65.9	3.80	
Cortland	87	40	65.2	2.80	
Dekalb Junction	.....	.....	.....	3.18	
Dryden	90	35	65.5	2.50	
Elizabethtown	84	36	62.6	.....	
Elmira	90	40	69.3	3.43	
Fayetteville	.....	.....	.....	2.14	
Fleming	90	44	68.4	2.48	
Fort Niagara †	89	43	67.0	3.15	
Franklinville	87	35	64.2	4.79	
Garrattsville	89	37	64.7	.....	
Gloversville	88	39	65.9	5.14	
Greenwich	87	40	66.6	2.86	
Haskinsville	.....	.....	.....	3.95	
Hemlock Lake	87	43	67.8	3.52	
Honeymead Brook	86	44	66.9	2.73	
Humphrey †	86	40	65.0	6.87	
Ithaca	90	40	67.5	3.01	
Jamestown	87	44	67.0	5.01	
Keene Valley	84	37	60.7	2.50	
Kings Station	.....	.....	.....	3.24	
Lake George	85	40	66.0	3.35	
Lake Placid	82	38	61.7	4.82	
Liberty	85	46	64.4	3.47	
Little Falls	86	40	66.1	4.52	
Lockport	85	48	67.4	2.88	
Lowville	87	35	64.4	2.57	
Lyndonville	.....	.....	.....	2.32	
Lyons	91	45	68.2	2.86	
Madison Barracks †	.....	40	.....	2.50	
Middletown	90	43	68.2	3.84	
Milford	.....	.....	.....	3.09	
Mohonk Lake	85	50	67.8	2.07	
Mount Morris	.....	.....	.....	2.40	
Napoli	.....	.....	.....	6.02	
Newark Valley	.....	.....	.....	3.27	
New Lisbon	86	33	63.0	3.04	
Niagara Falls	.....	.....	.....	2.55	
North Hammond †	88	42	66.4	2.08	
North Lake	82	36	61.4	4.56	
Number Four †	82	35	62.0	2.77	
Nunda	92	37	67.7	6.78	
Ogdensburg	89	48	66.4	2.82	
Oneonta	92	36	66.6	5.13	
Oxford	91	36	67.2	3.58	
Palermo	90	36	65.2	1.20	
Penn Yan	94	40	69.4	3.35	
Perry City	91	33	65.8	3.47	
Phœnix	.....	.....	.....	2.51	
Pine City	.....	.....	.....	3.59	
Plattsburg Barracks †	85	45	65.8	2.62	
Port Jervis	92	44	69.9	4.15	
Poughkeepsie	96	42	68.8	1.53	
Primrose	94	44	68.4	1.28	
Ridgeway	88	44	66.6	3.02	
Rome	90	40	67.2	3.76	
Romulus	91	41	68.8	3.42	
Rose	.....	.....	.....	1.26	
St. Johnsville	90	40	67.8	4.14	
Saranac Lake	85	36	63.4	4.06	
Saratoga Springs	90	42	68.0	3.08	
Setauket †	90	48	67.1	0.62	
Sherwood	.....	.....	.....	3.70	
Skaneateles	.....	.....	.....	3.50	
South Canisteo	88	32	63.0	2.90	
Southeast Reservoir	.....	.....	.....	1.39	
South Kortright †	89	33	64.4	3.70	
Straits Corners	91	36	66.5	3.66	
Ticonderoga	83[c]	45	66.4[d]	3.08	
Victor	92	37	68.0	2.41	
Wappingers Falls	93	48	70.8	2.47	
Warwick	.....	.....	.....	2.59	
Watertown	94	41	68.4	1.66	
Watkins	93[d]	37[d]	67.4[d]	2.14	
Waverly †	91	36	68.2	2.28	
Wedgwood	93	38	67.6	2.72	
Westfield	87	46	68.0	6.17	
Westpoint †	93	50	69.4	1.85	
Willetspoint	93	50	69.2	1.13	
North Carolina.					
Abshers	96	46	72.5	2.25	
Asheville †	.....	.....	.....	6.00	
Beaufort †	88	59	75.1	5.57	
Biltmore †	92	48	72.2	4.34	
Bryson City †	.....	.....	.....	2.60	
Chapelhill †	99	51	76.2	2.66	
Edenton	95	56	75.0	4.53	
Fairbluff †	.....	.....	.....	2.27	
Fayetteville †	99	53	76.7	5.53	
Flatrock	93	47	70.6	3.66	
Goldsboro	104	53	78.3	2.53	
Greensboro †	95	54	74.5	2.94	
Greenville	96	62	79.0	1.15	
Henderson †	98	54	75.0	4.11	
Hendersonville	92	48	71.1	5.71	
Highland[a]	85	47	66.6	1.68	
Horse Cove	93	54	73.7	2.01	
Lenoir *† [1]	90	58	73.5	3.20	
Linville †	83	40	64.8	4.58	
Littleton †	97	51	74.2	2.93	
Louisburg †	99	53	75.9	1.63	
Lumberton †	99	57	78.8	2.29	
Mana	.....	.....	.....	1.80	
Marion	97	52	73.6	3.88	
Moncure †	97	50	75.6	1.35	
Monroe †	101	48	77.0	3.46	
Morganton	94	56	74.2	3.51	
Mountairy	93	49	72.0	3.49	
Mount Pleasant	97	53	76.7	2.55	
Murphy †	.....	.....	.....	3.75	
Newbern	100	54	78.0	4.91	
Oakridge †	97	50	74.4	2.15	
Pantego	.....	.....	.....	5.64	
Pittsboro †	95	49	74.2	2.72	
Rockingham †	102	54	79.4	4.26	
Roxboro †	95	50[c]	72.2[c]	5.68	
Salem †	97	50	75.6	2.39	
Salisbury †	100	52	78.0	2.08	
Saxon †	97	50	72.8	4.35	
Selma	101	50	78.6	3.77	
Settle	98	50	74.8	1.42	
Sloan †	98	55	77.8	7.32	
Soapstone Mount †	100	44	74.0	2.51	
Southern Pines *a* †	101	52	76.4	3.52	
Southern Pines *b*	98	57	76.6	2.43	
Southport †	88	58	76.5	3.24	
Springhope *[1]	95	58	74.3	0.70	
Tarboro	102	52	77.0	3.40	
Waynesville †	91	48	70.4	3.11	
Weldon †	100	55	76.6	5.18	
North Dakota.					
Amenia	94°	37°	63.8°	2.51	
Aneta	91	32	66.2	2.65	
Ashley †	100	36	64.0	0.68	
Berlin	95	33	63.2	1.83	
Bottineau	95	33	59.1	3.11	
Buxton	86°	41°	61.6°	4.48	
Churchs Ferry	92	29	62.2	4.20	
Coal Harbor	98	40	63.3	2.49	
Devils Lake	89	33	61.7	3.50	
Dickinson	95	37	62.6	1.30	
Ellendale	96	42	64.8	0.94	
Fargo †	97	33	61.5	2.25	
Forman †	98	38	65.5	1.02	
Fort Berthold	104	34	65.0	2.24	
Fort Yates †	95	38	62.6	3.32	
Fullerton [1]	97°	36	65.0	1.56	
Gallatin †	92	34	61.6	2.80	
Glenullin	97	38	62.4	1.12	
Goetz	96	31	62.7	4.22	
Grafton †	88	36[c]	61.0[d]	4.45	
Hamilton	88	34	57.8	6.16	
Jamestown †	95	42	63.8	1.94	
Kelso	92	40	63.4	5.86	
Langdon	88	28	58.6	5.36	
Larimore †	86	35	59.9	3.62	
Lisbon	98	37	64.7	0.93	
McKinney	95	29	61.0	3.13	
Medora †	105	39	66.0	2.80	
Melville	93	30	64.4	3.38	
Milton †	88	28	57.9	3.70	
Minnewaukon	87	30	61.2	4.39	
Minot	93	34	65.2	3.00	
Minto †	93°	33[d]	63.1[d]	4.97	
Napoleon †	96	35	63.9	2.07	
New England City	92	40	61.3	1.20	
Oakdale †	93	39	61.6	4.49	
Pembina	91	35	61.0	5.51	
Portal	96	29	59.8	3.40	
Power †	93	34	62.0	2.36	
St. John †	89	35	60.1	3.61	
Towner †	92	30	61.6	6.35	
University	85[c]	36[c]	59.9[c]	6.08	
Valley City †	90	38	63.2	3.29	
Wahpeton †	99	37	67.3	1.79	
Washburn	100	27	63.4	2.78	
White Earth [1]	100	33	62.1	4.00	
Whites Ranch	.....	43	.....	1.27	
Wildrice † [2]	.....	.....	63.4	1.70	
Willow City	91	28	61.4	3.68	
Woodbridge †	93	26	59.7	4.08	
Ohio.					
Akron	92	44	69.8	1.76	
Annapolis	94	40	71.2	2.55	
Ashland	89	46	69.7	2.16	
Ashtabula	88	44	67.8	3.84	
Atwater	.....	.....	.....	2.60	
Bangorville	93	45	70.7	3.50	
Bellefontaine	87	51	71.8	2.53	
Bement	.....	.....	.....	4.84	
Benton Ridge	94	45	71.2	1.39	
Bethany	96	54	77.2	2.44	
Bigprairie	93	44	71.2	2.83	
Binola	.....	.....	.....	4.55	
Bladensburg	94	40	69.7	2.68	
Bloomingburg	92	47	72.0	1.18	
Bowling Green	92	43	70.0	2.78	
Bucyrus	94	46	70.7	2.46	
Cambridge	91	41	69.2	2.91	
Camp Dennison	95	48	75.0	2.09	
Canal Dover	91	43	70.4	3.39	
Canton †	92	47	70.8	5.03	
Carrollton	94	42	75.1	3.91	
Cedarville	.....	.....	.....	2.29	
Celina	96	44	71.4	1.79	
Chillicothe	93	47	73.4	1.66	
Circleville	93	47	73.4	1.08	
Clarksville	92	44	73.4	2.30	
Cleveland *a*	88	49	69.1	3.75	
Cleveland *b*	90	49	69.4	3.90	
Coalton	94	42	72.7	2.85	
Dayton *a*	96	46	73.7	3.24	
Dayton *b* †	.....	.....	.....	2.95	
Defiance	89	46	69.5	3.31	
Delaware	90	49	73.8	2.45	
Demos	90	49	70.7	3.56	
Dupont	93	52	72.4	1.91	
Elyria	95	46	70.2	5.48	
Fairport Harbor *[10]	87	54	69.1	.....	
Findlay	95	45	71.8	1.97	
Frankfort	91	42	75.2	1.65	
Garrettsville †	90	40	67.4	2.96	
Granville	94	43	71.6	3.09	
Gratiot	91	45	71.4	3.43	
Greenfield	93°	51°	79.7°	2.10	
Greenhill	90	39	68.0	5.13	
Greenville	87	48	70.1	2.75	
Hanging Rock	96	46	73.4	4.61	
Hedges	91	41	70.0	1.49	
Hillhouse	90	40	67.6	3.44	
Hillsboro †	97	42	74.0	2.24	
Hiram	90	48	69.0	3.90	
Hudson	93	50	71.5	2.69	
Jacksonboro	97	.....	.....	1.50	
Kenton	94	47	71.4	2.19	
Killbuck	92	44	70.3	2.35	
Lancaster	89	46	71.2	3.65	
Leipsic	96	42	70.7	1.75	
Levering	95	41	69.8	3.40	
Logan	95	.....	.....	1.63	
Lordstown	89	43	68.6	5.15	
McArthur	90	40	70.4	2.69	
McConnelsville †	92	45	72.0	4.14	
Mansfield †	.....	.....	.....	2.91	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Marietta *b*	90	50	72.3	5.04	
Marion	94	45	71.4	3.15	
Medina	93	40	69.1	1.71	
Milfordton	90	42	69.8	2.96	
Milligan	96	40	72.3	2.44	
Millport	88	40	70.2	7.05	
Montpelier	92	39	69.2	2.74	
Napoleon	96	42	70.2	1.33	
Neapolis				2.98	
New Alexandria	91	49	70.2	5.19	
New Berlin	93	43	70.0	3.07	
New Bremen	97	42	71.9	0.84	
New Holland	95	45	73.8	0.96	
New Moscow				2.71	
New Paris	89			2.62	
New Waterford	93	44	69.7	5.57	
North Lewisburg	93	46	72.8	3.50	
North Royalton	92	44	70.0	3.62	
Norwalk	95	44	70.5	2.65	
Oberlin	92[a]	44[d]	70.8[d]	4.03	
Ohio State University	94	46	72.4	2.01	
Orangeville	91	42	68.2	2.55	
Ottawa	92	47	71.8	2.44	
Pataskala †	97	44	72.9	2.36	
Perry				2.20	
Philo	95	46	73.3	3.24	
Plattsburg	91	46	71.3	4.67	
Point Marblehead *10	92	60	74.1		
Pomeroy	96	46	73.7	1.95	
Portsmouth *a* †				3.13	
Portsmouth *b*	98	49	75.8	3.13	
Richwood	90	52	73.4	2.55	
Ridgeville Corners [d]	92	42	69.6	2.33	
Ripley	96	50	74.5	3.37	
Rittman	90	39	67.4	3.83	
Rockyridge	94	47	71.1	4.00	
Rosewood	90	44	70.3	2.36	
Seaman	99	43	75.4	2.65	
Sidney *b*	94	48	72.1	3.01	
Sinking Spring †	90	47	72.8	2.53	
Somerset †	92			3.63	
Springboro				1.65	
Strongsville				5.60	
Sylvania	93	41	68.8	2.18	
Thurman	92	45	72.0	3.09	
Tiffin †	93	48	71.3	1.76	
Upper Sandusky	92	46	71.4	1.32	
Urbana	88	45	70.8	3.08	
Vanceburg	94	48	73.3	4.83	
Vanwert	94	45	71.8	2.09	
Vermillion	90	45	69.0	5.60	
Vickery	95	44	70.1	2.44	
Walnut				1.15	
Warren	92	43	70.0	3.78	
Warsaw	96	41	73.1	2.76	
Wauseon	94	44	70.3	3.57	
Waverly	96	44	75.5	2.30	
Waynesville	94	44	73.0	1.62	
Wellington	95[c]	46[c]	71.7[c]	2.38	
Westerville	91	47	71.2	2.09	
Willoughby				2.23	
Wooster *b* †	90	40	68.7	2.70	
Youngstown	94	42	70.6	3.62	
Zanesville †				4.02	
Oklahoma.					
Anadarko †	99	60	80.2	3.76	
Arapaho †	101	57	77.6	5.60	
Beaver	99			1.80	
Burnett †	92	61	76.6	2.49	
Clifton †	94	58	73.8	2.96	
Fort Reno †	92	56	75.4	4.39	
Fort Sill	94	62	77.4	4.00	
Guthrie	98	66	80.8	1.66	
Hennessey		60		5.36	
Hopeton	97	57	77.6	4.90	
Jefferson	102	60	78.8	7.42	
Kingfisher	98	60	78.8	3.18	
Mangum †	99	57	76.8	7.79	
Newkirk	102	59	79.1	5.95	
Norman †	95	62	78.3	3.97	
Pawhuska	94	61	76.6	8.58	
Prudence †		56		3.34	
Sac and Fox Agency	95	60	76.8	2.33	
Stillwater †	95	61	77.0	4.72	
Waukomis	101	57	79.4	3.40	
Winnview	97	59	77.0	2.88	
Oregon.					
Albany *a*	88	42	62.1	1.75	
Albany *b*				2.23	
Arlington	97	37	67.3	0.61	
Ashland *b*	93	35	62.0	1.28	
Aurora *1	92	50	63.8	1.79	
Aurora (near)	92	39	61.6	1.60	
Bandon	74	46	58.6	2.32	
Bay City †	93	39	59.6	6.89	
Beulah	94	26	61.8	0.35	
Oregon—Cont'd.					
Brownsville *1	91	54	65.7	0.97	
Burns	87	25	57.8	0.32	
Burns (near)	87	28	59.5	0.33	
Cascade Locks	90	44	63.3	1.83	
Comstock *1	91	45	61.2	1.58	
Coquille River				0.30	
Dayville †	92	36	62.7	0.79	
Eugene				1.66	
Fairview	95	35	57.6	1.48	
Falls City	89	38	59.9	2.45	
Gardiner	91	44	59.4	3.06	
Glenora	93	37	59.2	3.99	
Government Camp	82	29	51.0	3.01	2.0
Grants Pass *a* †	94	36	63.5	0.85	
Happy Valley	87	25	56.2	0.76	
Heppner	92	35	60.8	1.52	
Hood River (near)	91	43	62.2	1.31	
Jacksonville	90	36	63.0	2.30	
Joseph	87	29	56.4	2.24	0.2
Junction City *1	102	48	63.6	1.13	
Klamath Falls	95	28	62.2	T.	
Lafayette *1	98	48	63.6	2.00	
Lagrande	87[b]	36[b]	62.6[f]	0.61	
Lakeview †	87	30	59.6	0.24	T.
Langlois	92	40	61.2	3.60	
Lone Rock	89	33	58.4	1.92	
McMinnville	94	38	61.8	1.62	
Merlin *1	100	40	64.1	1.50	
Monmouth *a* *1	92	50	64.6	2.77	
Monroe	93	39	61.8	1.27	
Moro	93	37	60.8	0.77	
Mount Angel †	97	42	63.3	1.98	
Nehalem				4.16	
Newberg	95	40	61.5	1.51	
Newbridge	96	33	64.1	0.73	
Newport	91	42	57.2	3.42	
Pendleton	99	36[b]	68.3[g]	0.94	
Placer				1.48	
Prineville	98	23	61.2	0.30	
Riddles *1	94	40	60.8	0.57	
Riverside	99	25	62.0	0.31	
Salem *b* †	89	40	62.6	1.61	
Sheridan *1	92	47	61.7	0.77	
Silver Lake	86	26	56.2	0.76	
Silverton *1	96	52	69.6	2.05	
Siskiyou *1	90	39	66.5	0.00	
Sparta	87	32	58.4	0.32	
Springfield *1	86	47	62.6	1.39	
Stafford	91	41	61.2	2.37	
The Dalles †	97	42	65.9	0.90	
Tillamook Rock				1.66	
Toledo	89	40	61.4	9.75	
Umatilla				0.56	
Vale	97	32	64.0	0.71	
Vernonia	96	36	58.8	2.39	
West Fork *1	98	42	62.5	0.75	
Weston	91	39	62.6	0.51	
Williams	90	35	61.8	1.61	
Pennsylvania.					
Altoona	91	41	68.6	1.99	
Aqueduct	100	54	76.0	2.29	
Athens	91	36	68.0	2.44	
Beaver Dam				6.67	
Bethlehem				1.05	
Brookville †				2.95	
Browers Lock				3.10	
Cameron				6.36	
Carlisle	97	47	72.0	1.24	
Cassandra	85	41	66.8	3.11	
Cedarrun				6.00	
Centerhall †	89	45	67.8	2.89	
Chambersburg †	96	44	71.0	0.64	
Coatesville	97	45	71.7	1.42	
Confluence †	92	44	69.2	3.14	
Coopersburg	93	48	72.8	1.04	
Davis Island Dam †				4.88	
Derry Station	93	45	71.9	4.58	
Doylestown				1.18	
Driftwood				2.90	
Duncannon				1.87	
Dushore	91	34	65.2	3.30	
East Bloomsburg				2.14	
East Mauch Chunk	95	44	70.3	1.36	
Easton	92	46	70.8	1.90	
Ellwood Junction †				6.96	
Emporium	89	42	67.2	3.90	
Everett	92	43	68.3	2.03	
Farrandsville				3.05	
Forks of Neshaminy *1	94	60	75.2	0.82	
Franklin	90	45	68.0	3.41	
Frederick				0.63	
Freeport †				3.98	
Girardville				2.38	
Grampian	86	44	67.8	5.03	
Greensboro †	95	45	71.6	4.42	
Greenville	90	51	72.6	3.60	
Hamburg	98	46	72.8	1.47	
Hawley	95	42	70.4	3.50	
Hews Island Dam				4.23	
Hollidaysburg	96	39	70.2	1.52	
Huntingdon *a* †	96	40	70.0	2.29	
Huntingdon *b*				2.07	
Irwin				4.37	
Johnstown †	94	46	70.8	4.10	
Karthaus				0.77	
Keating				4.30	
Kennett Square	94	47	70.4	3.07	
Lansdale				0.74	
Lawrenceville				3.23	
Lebanon	98	43	70.8	1.30	
Leroy †	88	40	66.4	2.75	
Lewisburg	95	41	69.5	2.79	
Lock Haven *a* †	96	43	70.8	3.87	
Lock Haven *b*				3.45	
Lock No. 4 †				3.02	
Lycippus	89	44	70.1	2.99	
Mifflin				2.35	
Oil City †				4.56	
Ottsville				0.75	
Parker †				5.89	
Philadelphia *b*	95	51	73.0	1.96	
Point Pleasant				0.79	
Pottstown	96	50	73.1	1.66	
Quakertown	93	42	71.0	0.89	
Reading [2]			72.9	0.56	
Renovo *a*				4.76	
Renovo *b*	91	42	68.8	4.36	
Ridgway †				3.01	
Saegerstown	91	38	66.4	5.12	
St. Marys	88	39	66.6	3.19	
Salem Corners	86	47	67.8	3.79	
Scranton	91	44	59.4	2.20	
Seisholtzville				1.30	
Selinsgrove	94	42	69.9	1.61	
Shawmont				2.56	
Shinglehouse	88	33	64.8	4.04	
Sinnamahoning				3.03	
Smethport	88	34	64.6	4.50	
Smiths Corners				0.60	
Somerset				2.44	
South Eaton	90	45	68.3	1.63	
State College	89	42	67.8	3.53	
Sunbury				1.68	
Swarthmore	93[c]	50[c]	73.1[c]	1.74	
Towanda	91	40	67.6	3.04	
Trout Run				4.98	
Uniontown	90	46	72.0	3.27	
Warren †	88	42	66.7	5.95	
Wellsboro †	88	35	65.6	2.70	
West Chester	92	49	71.2	3.55	
West Newton †				2.67	
Westtown	92	48	69.6	2.94	
White Haven	92	42	67.4	2.70	
Wilkesbarre †	94	43	70.2	3.29	
Williamsport	90	45	69.4	2.73	
York †	97	43	71.4	1.08	
Rhode Island.					
Bristol	84	47	64.0	1.27	
Kingston	88	43	64.1	0.77	
Lonsdale				1.24	
Pawtucket	91	48	69.1	1.11	
Providence *a*	92	50	69.8	1.16	
Providence *c*	89	46	66.2	1.25	
South Carolina.					
Allendale	99	60	79.4	4.47	
Anderson †				3.98	
Batesburg †	103	61	81.8	2.04	
Blackville †	101	60	81.4	3.82	
Camden †				4.91	
Central	100	59	80.6	1.58	
Cheraw *a* †	103	56	79.5	6.89	
Cheraw *b* †				7.59	
Clemson College *a*	99	58	79.4	1.71	
Conway †				5.05	
Darlington				8.30	
Edisto †				4.00	
Effingham †				3.40	
Florence	98	60	80.2	5.20	
Gaffney †				4.42	
Georgetown †	99	61	79.9	5.00	
Gillisonville	105	56	81.5	2.47	
Greenville †	94	60	76.2	2.18	
Greenwood	103	60	81.4	4.15	
Holland	98	56	77.7	1.67	
Kingstree *a* †	101	63	80.8	2.40	
Kingstree *b*				2.44	
Little Mountain	101	58	79.9	3.80	
Longshore †	98	58	78.9	3.69	
Mount Carmel †				2.77	
Pinopolis *1	94	64	76.8	10.68	
Port Royal †	98	65	81.8	2.54	
St. Georges †	98	61	79.9	5.46	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Matthews†	98	63	79.7	4.38	
St. Stephens†	....	....	....	6.54	
Santuck†	98	55	75.8	2.16	
Shaws Fork *1	102	65	80.8	6.53	
Smiths Mills†	....	....	....	5.52	
Spartanburg	99	59	79.0	3.83	
Society Hill†	97	60	79.3	4.57	
Statesburg†	100	60	80.5	2.65	
Trenton	96	55	81.0	2.29	
Trial	95	56	76.3	7.16	
Walhalla	97	56	76.1	1.85	
Winnsboro	98	60	78.7	6.40	
Yemassee†	101	60	81.0	3.13	
Yorkville	102	59	79.9	3.54	
South Dakota.					
Aberdeen†	98	42	67.3	0.94	
Alexandria†	96	43	68.3	3.89	
Ashcroft†	96	35	63.4	3.00	
Bowdle	101[c]	36[c]	65.4[c]	1.28	
Brookings†	91	42	66.3	1.94	
Canton	98	45	69.6	5.68	
Centerville	....	....	....	4.44	
Chamberlain†	100	46	71.4	0.97	
Desmet	91	42	66.9	1.97	
Doland	102	39	68.0	1.12	
Farmingdale	....	....	....	0.86	
Flandreau	93	45	66.2	2.40	
Forestburg†	98	40	67.6	1.81	
Forest City	103	44	70.4	0.85	
Fort Meade†	95	42	64.8	2.70	
Gannvalley	98	40	68.4	2.25	
Gary	95	45	68.2	3.33	
Goudyville	100	38	66.3	3.86	
Harney	93[d]	32[d]	62.0[d]	1.96	
Highmore	99[d]	41[d]	72.4[d]	1.67	
Hitchcock	....	....	....	1.57	
Hotch City†	101	39	68.2	0.90	
Hot Springs	100	41	66.8	0.33	
Howard†	94	40	67.0	2.49	
Interior	110	40	70.3	T.	
Ipswich	93	41	65.6	1.66	
Kimball†	99	41	68.2	2.26	
Leslie†	....	....	....	1.92	
Mellette†	99	41	69.2	5.19	
Menno†	97	43	69.8	3.43	
Millbank	97	40	65.7	3.52	
Mitchell†	96	41	67.8	2.58	
Montrose†	92	45	66.0	2.42	
Nowlin	106	38	68.6	0.13	
Oelrichs†	103	40	69.2	1.00	
Parker†	....	....	....	5.09	
Parkston	96	37	65.7	2.85	
Plankinton†	99	39	69.0	2.13	
Redfield	99	40	67.0	1.18	
Rochford	....	....	....	1.57	
Rosebud	103	36	69.3	0.60	
Shiloh	106	38	67.0	1.35	
Silver City	....	....	....	1.68	
Sioux Falls†	97	45	69.0	5.27	
Spearfish†	94	38	63.2	1.35	
Tyndall†	96	44	68.4	2.30	
Watertown	92	36	64.6	1.65	
Wentworth†	95	42	66.9	1.91	
Wessington Springs	98	39	65.6	0.94	
Whiteswan	....	....	....	1.68	
Wolsey	....	....	....	2.68	
Tennessee.					
Andersonville	98	52	75.4	1.41	
Arlington	97	61	79.6	2.69	
Ashwood	94	56	77.2	2.90	
Benton (near)†	101	53	76.8	4.14	
Bluff City†	....	....	....	4.60	
Bolivar†	94	58	77.7	1.63	
Bristol†	94	50	72.6	3.49	
Brownsville	97	62	80.5	2.39	
Byrdstown	95	58	74.6	3.40	
Carthage†	98	55	78.1	4.94	
Clarksville	92	59	77.1	4.49	
Clinton†	....	....	....	2.15	
Covington	97	64	81.4	2.14	
Decatur†	99	55	77.0	3.35	
Dover	95	57	77.9	4.02	
Dyersburg	99	62	80.3	3.34	
Elizabethton†	102	50	76.0	5.66	
Elk Valley	97	49	74.1	1.58	
Erasmus	95	45	70.8	4.89	
Florence†	95	59	78.0	1.91	
Franklin	93	58	77.2	3.58	
Grace *1	100	53	76.1	4.10	
Greeneville†	95	51	73.6	2.63	
Harriman	98	55	76.4	3.47	
Hohenwald †	95	56	77.8	2.90	
Jackson †	94	61	78.6	3.19	
Johnsonville	96	56	77.7	6.12	
Jonesboro *1	92	52	73.0	3.26	
Kingston †	....	....	....	2.65	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lafayette *5	95	57	76.2	4.42	
Lewisburg *5	98	59	78.2	1.92	
Liberty†	97	54	77.2	5.10	
Lynnville†	95	61	77.6	3.17	
McKenzie†	93	58	77.9	6.45	
McMinnville†	98	53	75.8	5.45	
Madison	97	58	78.2	4.10	
Maryville *5	100	54	77.5	3.10	
Milan	98	61	80.1	6.40	
Newmarket *5	97	56	77.6	3.95	
Newport†	100	54	75.8	2.81	
Nunnelly	93	55	75.8	3.54	
Oak Hill	96	54	75.5	5.62	
Palmetto†	100	55	78.1	2.54	
Peryear *5	92	55	78.0	7.02	
Pope	98	55	77.4	4.77	
Rogersville†	92	54	73.0	5.26	
Rugby	95	47	72.3	2.49	
Savannah	97	58	79.4	2.53	
Sewanee†	93	51	72.0	3.81	
Silverlake	89	44	67.8	2.51	
Springdale	99	42	74.8	2.42	
Springfield	97	56	78.1	3.75	
Sylvia	95	55	76.4	4.81	
Tazewell	....	....	....	3.39	
Tellico Plains†	99	55	76.6	4.26	
Tracy City	93	52	72.3	3.39	
Trenton	93	58	76.8	3.73	
Tullahoma†	96	54	74.8	2.60	
Union City	95	61	78.8	3.10	
Waynesboro	94	56	76.2	3.18	
Wildersville	92	60	77.2	3.56	
Yukon	97	61	77.8	6.11	
Texas.					
Albany *1	92	64	78.2	5.30	
Alvin	....	....	....	4.56	
Anna	....	....	....	5.00	
Anson	....	....	....	4.90	
Arthur City†	....	....	....	8.96	
Austin *a*	100	60	82.6	5.04	
Austin *b* *5	95	62	77.4	....	
Ballinger†	99	59	75.9	10.85	
Beeville†	100	62	82.6	2.05	
Blanco†	95	60	79.2	6.14	
Boerne *1	94	67	78.7	6.71	
Brazoria†	92	67	80.2	5.10	
Breckenridge	98	64	81.0	4.96	
Brenham†	93	65	80.8	4.05	
Brighton	92	58	77.2	2.44	
Brownwood	102	63	84.0	8.05	
Burnet *1	94	64	77.2	4.53	
Childress	101	57	78.6	6.01	
Coleman	96	60	77.0	9.08	
College Station[2]	93	....	79.7	5.15	
Colmesneil	....	....	....	5.81	
Columbia†	90	66	79.4	5.44	
Conroe	99	67	81.2	4.40	
Corsicana *b* †	99	62	81.4	9.25	
Cuero†	96	65	81.8	2.89	
Dallas†	95	62	78.6	9.18	
Danevang†	99	66	82.0	6.06	
Dublin†	96	62	78.2	6.63	
Duval *1	102	73	83.7	3.13	
Emory	91	64	77.0	7.05	
Estelle†	97	62	78.2	6.73	
Forestburg	98	62	78.8	6.65	
Fort McIntosh	104	67	85.0	2.83	
Fort Ringgold†	103	60	82.4	2.34	
Fort Stockton	....	....	....	2.62	
Fort Worth	99	64	80.8	4.97	
Fredericksburg *†1	95	67°	78.3°	5.85	
Fruitland	97	62	76.1	8.99	
Gainesville	92	65	78.0	5.19	
Golindo	....	....	....	6.55	
Grapevine	98	64	78.0	7.05	
Hale Center†	99	58	74.3	4.91	
Hallettsville†	97	66	82.5	3.97	
Haskell	100	58	78.8	3.68	
Hearne	98	68	83.8	2.45	
Henrietta	98	63	81.0	2.58	
Hewitt	....	....	....	6.29	
Honeygrove	....	....	....	5.85	
Houston†	93	68	80.0	6.46	
Hulen	98	....	....	4.89	
Huntsville†	96	66	81.2	6.82	
Jacksonville	91	67	78.8	6.96	
Jasper	98	65	80.3	6.47	
Junction	....	....	....	7.20	
Kent	....	....	....	3.98	
Kerrville	95	56	76.8	9.03	
Lampasas†	97	62	79.7	6.62	
Langtry	....	....	....	5.96	
Llano *† 5	95	66	80.0	5.44	
Longview†	101	66	81.9	5.21	
Luling†	99	66	82.6	3.83	
Mann	99°	64[d]	80.3°	5.35	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Marathon	96	48	71.6	2.89	
Marshall	....	....	....	9.00	
Menardville	98	60	78.2	8.26	
Mount Blanco†	101	56	75.8	0.25	
New Braunfels†	100	64	81.5	7.60	
Panter	....	....	....	6.29	
Paris	96	65	79.3	1.73	
Point Isabel *1	90	80	84.0	0.08	
Rheinland†	101	60	79.8	2.13	
Roby	....	53	....	5.21	
Rockport *1	88	72	80.2	....	
Rocksprings	....	....	....	5.87	
Runge†	96	64	82.1	3.39	
San Antonio	98	64	82.3	7.33	
San Marcos *b*†	96	64	80.4	6.85	
Sugarland	....	....	....	5.47	
Temple *a*	94	63	78.8	5.92	
Temple *b*	....	....	....	4.37	
Tulia	....	....	....	5.55	
Tyler	98	63	79.7	2.69	
Valentine†	101	40	75.4	....	
Victoria	....	....	....	2.98	
Waco	98	68	83.8	3.54	
Waxahachie†	96	64	78.5	8.60	
Weatherford†	95	58	79.0	6.65	
Wichita Falls†	....	....	....	4.85	
Utah.					
Alpine†	....	....	....	1.43	
Blue Creek *1	90	43	66.2	1.29	
Cisco†	105	39	73.8	0.22	
Corinne	99	32	66.4	0.56	
Ferron	100	33	68.4	0.43	
Fillmore†	102	33	66.4	0.92	
Fort Duchesne†	97	33	64.8	0.45	
Frisco	98	30	67.4	0.11	
Heber	94	32	61.4	0.83	
Huntsville	....	....	....	0.80	
Kelton *1	97	48	71.1	0.00	
Levan†	94	29	63.4	0.90	
Logan†	94	35	63.8	0.85	
Millville	....	....	....	0.55	
Minersville	95	31	67.4	0.46	
Moab†	102	38	72.0	0.16	
Mount Pleasant†	110	30	69.2	0.52	
Ogden *a* *1	98	38	71.5	0.81	
Pahreah	101	38	69.8	1.20	
Parowan†	93	30	64.9	0.24	
Pinto	92	35	60.6	0.25	
Promontory *1	92	36	69.2	1.50	
Provo	100	32	66.4	1.55	
Richfield†	93	28	59.0	1.00	
St. George†	108	40	76.2	0.39	
Scipio†	98	24	64.1	1.10	
Soldier Summit	95	22	57.5	0.13	
Terrace *1	94	27	61.8	2.25	
Thistle	100	28	62.8	0.00	
Tooele†	93	32	66.2	1.58	T.
Tropic	106	27	63.0	0.81	
Woodruff	86	28	55.3	0.93	
Vermont.					
Bennington	90	40	66.1	4.60	
Brattleboro	91	39	67.6	4.47	
Burlington†	84	50	67.2	2.93	
Chelsea†	83	37	62.8	2.34	
Cornwall	85	41	64.7	3.23	
Enosburg Falls	87°	39°	64.5°	3.45	
Hartland†	84	35	63.1	4.18	
Jacksonville	85	34	63.9	3.02	
Norwich	89	34	63.6	3.85	
St. Johnsbury	84	38	64.0	3.55	
Vernon *6	91	50	68.1	6.95	
Wells	85	38	65.2	3.57	
Woodstock	85	34	62.2	2.37	
Virginia.					
Alexandria	98	51	75.4	0.45	
Ashland†	98	53	73.4	3.94	
Ballsville	99	55	76.4	2.08	
Barboursville	93	50	72.6	3.97	
Bedford City	97	50	75.0	2.53	
Bigstone Gap†	95	48	72.6	4.86	
Birdsnest *†1	98	59	74.7	2.70	
Blacksburg	88	42	67.9	3.13	
Buckingham†	97	48	72.8	1.75	
Burkes Garden	....	....	....	5.39	
Callaville†	95	50	72.8	2.01	
Charlottesville	92	53	73.0	4.69	
Christiansburg	....	....	....	2.52	
Clarksville	....	....	....	4.18	
Clifton Forge	92	40	71.5	1.28	
Dale Enterprise†	95	41	69.6	4.83	
Danville	....	....	....	4.00	
Doswell	104	48	76.0	2.25	
Farmville	98	53	73.6	2.80	
Fredericksburg†	101	51	75.7	2.02	
Hampton	94	60	74.0	2.40	
Lexington†	90	47	70.4	4.72	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Maidens	.....	.....	.....	4.01	
Manassas†	100	47	73.7	1.10	
Marion	96[d]	45[d]	71.4[e]	4.10	
Miller School	95	51	73.2	3.63	
Petersburg†	99	54	74.0	2.57	
Radford	.....	.....	.....	3.59	
Richmond (near)†	99	53	73.8	2.34	
Rockymount†	95	50	74.0	3.34	
Salem†	90	53	73.5	2.82	
Speers Ferry	.....	.....	.....	4.71	
Spottsville†	99	52	75.0	3.80	
Stanardsville†	94	47	71.3	2.51	
Staunton†	95	45	71.5	2.16	
Stephens City†	98	48	72.8	1.49	
Sunbeam†	96	53	74.0	2.99	
Warrenton	97	57	76.0	1.44	
Warsaw†	99	51	73.9	1.64	
Westbrook Farm	99	54	74.5	.....	
Westpoint	94	44	71.9	3.85	
Woodstock†	97	45	71.6	1.12	
Wytheville†	92	45	70.4	2.17	
Washington.					
Aberdeen	94	43	60.5	3.35	
Ashford†	.....	.....	.....	4.61	
Blaine†	85	32	56.7	2.65	
Brinnon	83	45	60.4	2.85	
Centerville†	97	31	60.9	0.85	
Clearwater	91	42	58.8	8.56	
Colfax	.....	.....	.....	0.70	
Coupeville†	85	42	60.3	2.89	
Dayton	93	35	63.0	0.98	
Ellensburg	88	34	62.2	0.73	
Ellensburg (near)	96	40	64.6	0.86	
Fort Simcoe†	95	33	63.8	0.35	
Fort Spokane	94	35	62.4	0.80	
Grandmound†	92	39	60.5	3.04	
Hunters†	82	28	54.5	1.45	
Kennewick†	103	40	69.8	0.34	
Lacenter	93	37	61.6	2.19	
Lakeside	87	44	64.4	1.54	
Lapush	82	38	55.7	6.82	
Loomis†	90	39	65.4	1.94	
Madrone†	86	40	59.8	1.85	
Moxee Valley†	96	34	65.0	0.29	
New Whatcom	76	40	58.1	2.95	
Northbend	89	35	60.8	4.89	
Olga	80	40	56.9	2.15	
Olympia†	91	39	60.3	2.68	
Orcas Island	84	47	61.0	2.24	
Pinehill†	94	41	62.8	1.03	
Pomeroy	90	46	66.9	0.40	
Port Townsend	79	42	57.9	2.91	
Pullman†	88	36	60.2	1.54	
Rosalia†	86	31	58.8	0.40	
Sedro†	88	39	61.5	4.71	
Shoalwater Bay*[10]	86	45	58.4	.....	
Snohomish†	88	50	65.2	1.96	
Southbend	91	40	58.9	3.75	
Stampede	88	36	56.6	3.72	
Sunnyside†	97	36	66.6	0.49	
Union City†	88	40	59.8	3.40	
Vancouver	90	40	61.2	2.01	
Vashon†	85	43	59.2	2.21	
Waterville	94	32	57.8	1.50	
West Virginia.					
Beckley	86	43	66.6	2.06	
Beverly†	91	42	67.0	2.76	
Buckhannon*a*†	.....	.....	.....	3.97	
Burlington†	95	43	70 2	0.66	
Charleston†	.....	.....	.....	3.58	
Dayton†	94	41	70.4	1.77	
Eastbank	94	54	73.0	4.40	
Elkhorn†	91	46	69.9	5.87	
Fairmont†	.....	.....	.....	3.36	
Glenville†	89	48	70.0	3.80	
Grafton†	92	43	69.7	4.48	
Green Sulphur	90	48	69.8	2.13	
Harpers Ferry	.....	.....	.....	1.08	
Hinton*a*†	.....	.....	.....	2.80	
Hinton*b*†	93	51	72.0	.....	
Huntington	96	48	74.4	4.36	
Kingwood	87	44	67.8	4.93	
Marlinton†	87	41	69.9	7.50	
Martinsburg†	99	47	71.6	1.42	
Morgantown*b*†	91	47	71.4	5.17	
New Cumberland	93	46	72.7	4.00	
New Martinsville	97	48	75.2	2.34	
Nuttallburg	88	41	67.2	3.10	
Oldfields†	93	43	69.2	1.81	
Philippi	97	44	72.6	3.50	

Stations	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Point Pleasant†	97	48	74.7	2.87	
Powellton	93	48	0.6	2.76	
Romney	94	45	71.4	0.97	
Rowlesburg†	.....	.....	.....	2.57	
Upper Tract	94	39	70.2	2.09	
Weston*a*	.....	.....	.....	3.44	
Weston*b**†[1]	91	50	72.3	.....	
Wheeling*a*†	.....	.....	.....	2.98	
Wheeling*b*†	94	50	76.2	2.89	
Wisconsin.					
Amherst	90	39	67.5	2.40	
Barron	88	34	60.9	2.27	
Bayfield	94	40	60.0	1.90	
Beloit	89	46	67.0	9.70	
Brodhead	91	43	69.2	7.30	
Chilton	90	37	67.0	2.02	
Citypoint	92	38	68.0	3.38	
Delavan	90	40	69.0	6.21	
Dodgeville†	88	45	68.4	5.91	
Easton	92	38	68.4	3.00	
Eau Claire	93	45	69.0	1.50	
Florence†	87	31	62.9	3.77	
Fond du Lac	92	40	67.4	1.81	
Grand River Locks	.....	.....	.....	5.19	
Grantsburg†	95	40	67.1	6.00	
Gratiot	90	38	68.1	9.22	
Hartford	.....	.....	.....	4.40	
Hartland	91	41	67.7	1.98	
Harvey	91	42	69.2	4.01	
Hayward	91	38	65.6	7.18	
Heafford Junction*[1]	96	46	65.8	5.28	
Hillsboro	90	39	68.0	2.14	
Knapp	94	36	66.5	4.86	
Koepenick*†[1]	84	48	65.7	5.20	
Lancaster†	92	48	69.8	4.18	
Lincoln	92	41	64.0	3.78	
Madison†	86	54	69.1	4.40	
Manitowoc†	93	42	62.3	2.15	
Meadow Valley†	90	40	67.3	6.07	
Medford†	94	34	66.7	6.85	
Menasha	.....	.....	.....	3.35	
Neillsville	90	40	66.7	3.15	
New London	92	39	66.4	2.78	
North Crandon	.....	.....	.....	1.55	
Oconto	92	37	65.0	2.79	
Osceola†	93	41	65.6	4.92	
Pepin	94	43	68.4	2.38	
Pine River†	90	41	67.2	3.46	
Portage†	93	41	67.9	2.72	
Port Washington	94	40	65.0	2.41	
Prairie du Chien	94	48	72.4	2.26	
Prentice*[1]	90	46	61.4	4.97	
Racine	92	45	66.8	2.44	
Sharon	90	38	65.9	8.37	
Shawano	90	40	65.3	2.68	
Sheboygan*[10]	90	48	65.2	.....	
Spooner	92	42	63.9	7.81	
Stevens Point†	91[e]	41[e]	67.0[e]	5.16	
Sturgeon Bay Canal*[10]	80	42	59.9	.....	
Two Rivers*[10]	82	46	62.4	.....	
Valley Junction†	89	43	66.8	3.88	
Viroqua	90	47	62.0	2.22	
Watertown†	89	42	67.9	4.63	
Waukesha†	90	45	67.5	1.54	
Waupaca†	93	41	62.8	3.24	
Wausau†	89	42	65.9	2.07	
Wausaukee	92	42	67.4	2.84	
Westfield†	90	43	68.8	3.11	
Whitehall	93	41	69.1	2.90	
Wyoming.					
Basin	.....	.....	.....	0.80	
Big Horn Ranch	83	28	53.4	2.32	3.0
Big Piney	83	29	54.2	0.55	.....
Carbon	97	29	62.0	1.41	T.
Evanston	89	29	55.6	1.29	4.0
Fort Laramie†	99	34	66.8	1.27	
Fort Washakie	88	32	59.2	2.87	14.5
Fort Yellowstone†	87[b]	31	55.2[d]	2.67	
Green River	94[c]	29	63.7	.....	.....
Laramie	.....	.....	.....	0.90	.....
Lovell	96	34	63.3	1.20	
Lusk†	98	33	64.0	2.09	
Sheridan	90	34	59.4	1.11	
Sundance	86	39	61.8	1.86	
Wheatland	97	38	65.0	1.65	
Mexico.					
Ciudad P. Diaz	96	62	82.7	8.55	
Leon de Aldamas	90	54	71.4	4.79	
Puebla	81	45	62.2	4.32	
Topolobampo	88	74	83.5	T.	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Brunswick.	°	°	°	*Ins.*	*Ins.*
St. John	70	45	56.0	3.23	

Late reports for May, 1898.

Alaska.					
Coal Harbor	55	25	39.6	2.02	0.5
Arizona.					
Dragoon	.....	.....	.....	0.00	
Walnut Grove	.....	.....	.....	0.02	
Williams	81	23	51.8	2.03	14.0
California.					
Azusa	.....	.....	.....	3.17	
Chino*[6]	92	50	63.5	.....	
Craftonville	93	47	60.2	1.87	
Kernville	.....	.....	.....	0.40	
Mohave*[1]	96	38	63.9	0.00	
Mutah Flat	.....	.....	.....	1.02	
Point Fermin L. H	.....	.....	.....	0.94	
Point George L. H	.....	.....	.....	0.55	
San Miguel Island	64	48	54.0	0.71	
Wheatland	91	42	62.2	1.03	
Yuba City*[5]	88	53	66.5	1.47	
Colorado.					
Fox	.....	.....	.....	4.95	
Idaho.					
Idaho City[j]	92	28	61.5	.....	
Payette	96	30	61.9	2.07	
Illinois.					
Aurora*b*	82	36	59.0	4.98	
Charleston	84	41	63.4	4.79	
Fort Sheridan	81	37	55.2	2.43	
Grayville	88	39	68.8	6.38	
Kishwaukee	77	32	54.8	4.62	
Olney*a*	88	38	65.8	4.38	
Oswego*[1]	81	40	57.8	5.50	
Robinson	86	40	64.6	4.12	
Louisiana.					
Melville	.....	54	75.8	.....	
Maryland.					
Van Bibber	.....	.....	.....	5.89	
Michigan.					
Omer	.....	.....	.....	1.50	
Traverse City	.....	.....	.....	2.86	
Missouri.					
Malden	93	41	73.2	3.83	
North Carolina.					
Beaufort	.....	.....	.....	1.71	
Louisburg	91	30	67.6	.....	
New York.					
Lyons	80	37	60.0	3.57	
Washington.					
Waterville[k]	84	32	52.8	0.68	
West Virginia.					
Nuttallburg	.....	.....	.....	4.36	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

† Weather Bureau instruments.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[8] Mean of 7 a. m. + 2 p. m. + 9 p. m. ÷ 3.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

TABLE III.—*Data furnished by the Canadian Meteorological Service, June, 1898.*

Stations.	Pressure.			Temperature.				Precipitation.		
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	
St. Johns, N. F.	29.75	29.89	—.08	51.9	+ 0.3	60.9	42.9	2.68	.....	...
Sydney, C. B. I.	29.92	29.96	+.03	55.8	+ 0.4	65.3	46.4	2.04	—1.65	....
Halifax, N. S.	29.86	29.99	+.05	57.6	— 0.1	65.1	50.0	5.59	+1.69	....
Grand Manan, N. B.	29.89	29.94	—.02	55.7	— 0.5	63.1	48.4	2.96	+0.66	....
Yarmouth, N. S.	29.90	29.98	+.05	54.7	— 0.3	61.9	47.5	2.03	—0.11	....
Charlottet'n, P. E. I.	29.90	29.94	.00	58.1	+ 0.7	64.4	51.9	2.76	+0.01	...
Chatham, N. B.	29.90	29.92	+.02	59.7	— 0.3	69.4	50.0	4.62	+0.33	....
Father Point, Que.	29.88	29.91	+.05	53.3	+ 0.3	63.0	43.6	2.60	—0.09	....
Quebec, Que.	29.60	29.92	+.03	60.9	— 0.3	69.9	51.8	6.14	+2.87	....
Montreal, Que.	29.73	29.93	+.03	64.8	— 0.1	72.9	56.6	5.57	+2.38	....
Rockliffe, Ont	29.43	29.93	+.03	63.5	+ 2.1	75.3	51.7	4.59	+1.84	....
Ottawa, Ont	29.62	29.97	....	66.2	+ 0.9	76.8	55.6	2.24	.....	....
Kingston, Ont	29.64	29.95	+.01	64.2	+ 0.8	71.4	57.0	1.81	—0.59	....
Toronto, Ont	29.60	29.97	+.01	66.3	+ 2.9	76.2	56.5	1.95	—0.77	....
White River, Ont.	28.64	29.97	+.02	56.6	— 2.1	69.2	44.0	3.62	+1.65	....
Port Stanley, Ont	29.36	29.98	+.03	65.3	+ 1.5	75.6	55.1	2.67	—0.35	...
Saugeen, Ont.	29.28	29.98	+.04	63.0	+ 2.6	72.1	53.9	3.86	+1.49	....
Parry Sound, Ont	29.27	29.95	+.02	63.1	+ 1.4	73.4	52.8	3.45	+1.24	....
Port Arthur, Ont.	29.23	29.92	+.01	54.5	— 1.9	64.0	45.0	6.94	+4.13	....
Winnipeg, Man.	29.06	29.87	+.02	60.3	— 1.9	71.7	49.0	6.10	+2.26	....
Minnedosa, Man.	28.12	29.88	+.06	59.2	— 0.4	70.7	47.8	2.96	—0.83	....
Qu'Appelle, Assin.	27.64	29.85	+.03	58.8	— 1.1	71.6	46.1	4.60	+1.25	....
Medicine Hat, Assin.	27.62	29.85	+.06	61.9	— 0.1	75.2	48.6	1.51	—1.52	....
Swift Current, Assin.	27.37	29.89	+.07	59.8	— 0.2	72.2	47.4	2.56	—0.99	....
Calgary, Alberta	26.39	29.85	.00	56.4	+ 0.4	70.3	42.6	3.21	+0.87	....
Banff, Alberta	25.35	29.92	.....	51.1	.....	64.3	37.9	2.15	.....	....
Edmonton, Alberta	27.57	29.82	—.02	59.0	+ 2.1	73.8	44.2	2.80	+0.61	....
Prince Albert, Sask.	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Battleford, Sask.	28.15	29.85	.....	59.7	+ 0.2	72.5	46.9	4.24	.....	....
Kamloops, B. C.	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Esquimalt, B. C.	29.96	29.99	.....	57.8	+ 1.3	66.6	49.1	1.85	.....	....
Hamilton, Bermuda.	29.92	30.08	—.04	74.1	— 0.9	79.6	68.6	7.70	.....	....

TABLE IV.—*Mean temperature for each hour of seventy-fifth meridian time, June, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak.	59.6	58.9	57.8	57.0	56.1	55.1	55.5	57.1	58.7	61.7	64.6	66.8	68.6	70.4	72.1	73.0	73.8	73.5	72.6	71.4	69.5	66.4	63.8	61.9	64.4
Boston, Mass.	61.6	61.2	60.6	60.3	60.1	60.5	61.9	63.8	65.7	66.6	67.8	69.0	69.4	70.6	69.6	69.5	69.9	69.5	68.4	66.5	65.4	64.4	63.3	62.7	65.3
Buffalo, N. Y.	64.1	63.5	63.1	63.0	62.7	63.1	64.7	65.5	67.0	68.1	69.3	69.8	70.8	71.3	71.7	71.7	71.7	71.0	70.1	69.2	68.1	66.8	65.9	65.2	67.4
Chicago, Ill.	65.6	65.2	64.7	64.2	63.9	63.9	64.5	66.5	68.3	69.9	71.0	72.1	72.8	73.6	73.3	72.7	72.1	71.9	71.0	69.8	68.8	67.7	67.2	66.7	68.6
Cincinnati, Ohio.	71.7	70.6	69.6	68.7	67.5	66.9	67.8	70.4	72.6	74.7	77.2	78.6	80.3	82.2	83.4	84.2	84.4	83.9	82.0	80.2	78.1	76.4	74.9	73.4	75.8
Cleveland, Ohio	65.2	64.4	63.5	63.1	62.8	63.0	64.6	66.6	68.5	69.3	69.9	70.7	71.7	72.0	72.3	72.6	72.9	72.9	72.6	71.6	70.3	69.6	68.2	67.2	68.6
Detroit, Mich.	64.3	63.5	62.8	62.1	61.4	61.6	63.6	66.0	68.8	71.2	72.8	74.2	75.5	76.1	76.5	77.3	76.5	76.0	74.0	72.6	69.9	68.4	66.7	65.9	69.5
Dodge, Kans.	68.3	67.6	67.0	66.3	65.5	64.8	64.3	65.7	68.5	71.3	74.2	76.6	78.5	80.4	81.5	81.8	82.0	81.6	80.8	78.7	75.5	72.8	71.2	69.9	73.1
Eastport, Me.	50.5	50.1	49.6	49.4	49.3	50.0	51.3	52.9	54.3	55.4	56.7	57.2	57.8	58.1	58.6	58.0	58.2	56.9	55.2	53.6	52.6	52.1	51.7	51.2	53.8
Galveston, Tex.	79.8	79.5	79.5	79.3	79.0	78.8	79.0	79.6	80.3	81.3	82.5	82.7	83.6	83.8	83.7	83.7	82.9	82.4	81.9	81.1	80.5	80.2	80.2	80.2	81.1
Havre, Mont.	58.5	56.8	55.9	54.6	53.4	52.4	51.4	52.6	53.9	56.2	58.9	61.5	63.5	65.0	67.0	68.2	69.1	69.7	70.2	69.5	68.5	65.8	63.0	60.7	61.1
Key West, Fla.	71.9	71.2	70.5	70.1	69.5	69.0	68.9	70.1	72.6	74.5	76.5	78.3	80.0	81.3	82.2	82.9	83.0	82.3	81.1	79.3	77.4	75.7	74.4	73.4	75.7
Memphis, Tenn.	79.8	79.6	79.5	79.5	79.3	79.5	80.5	82.1	83.4	84.3	84.8	85.7	85.4	85.4	84.9	84.5	84.0	82.9	81.8	81.6	80.7	80.7	80.4	80.2	82.1
New Orleans, La.	75.8	75.0	74.2	73.5	72.9	72.3	72.0	73.6	75.2	77.5	80.2	82.5	83.3	84.3	85.2	85.9	86.0	84.6	82.1	81.3	80.0	78.9	77.8	76.8	78.8
New York, N. Y.	76.6	76.1	75.8	75.5	75.3	75.2	75.4	77.2	80.1	82.2	84.5	85.3	86.4	85.7	83.1	83.6	83.7	81.9	80.9	80.0	79.2	78.6	77.9	77.2	79.9
Philadelphia, Pa.	64.5	63.7	63.3	62.6	62.2	62.3	63.6	65.8	68.0	70.2	71.9	73.3	74.2	74.8	74.5	74.2	72.9	71.6	70.4	68.9	67.9	67.2	66.1	65.4	68.3
Pittsburg, Pa.	65.9	65.3	64.8	64.1	63.9	64.8	67.1	69.2	71.7	73.9	76.0	78.1	79.8	80.8	80.9	80.5	79.5	77.4	75.2	72.9	70.6	69.1	68.0	67.0	71.9
Portland, Oreg.	69.2	68.2	67.6	67.1	66.4	66.0	67.1	69.4	72.1	74.4	76.1	78.1	79.0	80.2	81.4	81.7	81.9	81.2	79.7	77.8	75.5	73.9	72.4	70.8	74.0
St. Louis, Mo.	61.8	60.3	59.3	58.2	56.9	56.3	55.0	54.4	54.1	55.7	57.5	59.5	61.8	63.5	64.7	66.8	68.0	69.2	69.4	69.9	69.5	68.2	65.7	64.0	62.1
St. Paul, Minn.	74.0	73.1	72.1	71.6	70.8	70.4	70.8	72.9	74.7	77.2	79.1	81.5	82.9	82.9	83.4	83.9	84.1	83.3	82.2	81.0	79.2	77.9	76.8	75.3	77.5
Salt Lake City, Utah.	65.3	64.0	63.0	62.3	61.4	60.8	60.9	62.1	63.7	65.6	67.9	70.3	72.4	73.7	75.0	75.7	75.8	75.5	75.1	73.8	71.7	70.0	68.1	66.6	68.4
San Diego, Cal.	63.1	62.1	60.5	59.3	58.6	57.6	56.7	59.5	61.9	65.7	68.5	71.1	73.5	74.8	75.9	77.2	77.3	76.8	77.1	76.9	74.7	70.6	66.7	65.0	68.0
San Francisco, Cal.	61.3	61.0	60.5	60.4	60.3	60.1	59.9	59.8	59.8	61.0	62.0	63.6	65.2	66.0	66.6	66.8	66.9	65.8	65.8	65.0	64.1	63.3	62.3	61.9	62.9
Savannah, Ga.	55.8	55.4	54.7	54.0	53.7	53.4	53.3	53.4	53.4	54.6	56.6	59.0	61.3	62.1	63.0	63.7	64.1	65.7	63.0	61.8	60.6	59.1	57.6	57.0	58.1
Washington, D. C.	74.2	73.7	73.3	72.6	72.3	72.3	74.8	77.4	81.9	84.5	86.6	88.1	88.7	87.5	86.3	84.0	82.1	80.3	78.9	77.9	76.7	76.2	75.6	75.0	79.2
	67.5	66.4	65.2	64.5	63.5	64.3	67.2	70.8	73.3	76.0	78.1	79.9	81.4	82.1	81.9	81.8	81.5	80.4	77.7	75.8	73.3	71.7	70.1	69.0	73.5

TABLE V.—*Mean pressure for each hour of seventy-fifth meridian time, June, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak.	28.154	.154	.154	.151	.153	.160	.168	.177	.180	.181	.178	.175	.167	.161	.152	.146	.137	.128	.125	.125	.134	.141	.156	.162	.155
Boston, Mass.	29.829	.825	.823	.828	.835	.847	.854	.856	.856	.854	.849	.842	.835	.829	.825	.818	.816	.818	.825	.831	.838	.840	.839	.834	.835
Buffalo, N. Y.	29.155	.152	.154	.156	.164	.173	.182	.189	.190	.188	.188	.182	.175	.166	.157	.150	.140	.136	.140	.142	.149	.152	.153	.153	.162
Chicago, Ill.	29.122	.118	.121	.121	.127	.135	.145	.153	.155	.154	.153	.150	.145	.132	.126	.119	.111	.107	.103	.101	.107	.119	.120	.122	.128
Cincinnati, Ohio	29.337	.356	.355	.358	.367	.375	.386	.394	.399	.398	.391	.387	.377	.364	.348	.337	.331	.325	.327	.330	.344	.353	.358	.361	.361
Cleveland, Ohio	29.191	.191	.188	.190	.197	.208	.216	.221	.224	.225	.224	.217	.210	.204	.194	.186	.176	.168	.170	.172	.178	.187	.189	.190	.197
Detroit, Mich.	29.221	.220	.218	.220	.226	.235	.244	.249	.256	.254	.249	.245	.234	.226	.216	.207	.200	.193	.198	.199	.212	.223	.225	.226	.225
Dodge, Kans.	27.367	.365	.362	.359	.363	.366	.376	.385	.391	.395	.392	.390	.381	.372	.363	.351	.342	.333	.327	.332	.342	.350	.363	.367	.364
Eastport, Me.	29.850	.847	.845	.850	.857	.866	.872	.874	.874	.874	.871	.867	.859	.854	.847	.843	.841	.842	.848	.853	.860	.861	.859	.858	.857
Galveston, Tex.	29.946	.943	.938	.936	.936	.944	.954	.961	.973	.979	.985	.986	.979	.967	.954	.944	.933	.924	.923	.928	.936	.945	.950	.953	.951
Havre, Mont.	27.305	.306	.310	.308	.307	.309	.317	.321	.324	.325	.320	.317	.311	.304	.296	.289	.280	.276	.271	.267	.278	.288	.298	.307	.301
Kansas City, Mo.	28.974	.965	.963	.964	.965	.973	.984	.992	.006	.006	.002	.000	.995	.983	.967	.959	.947	.940	.938	.941	.946	.958	.969	.975	.971
Key West, Fla.	30.054	.048	.045	.045	.038	.046	.054	.062	.069	.074	.075	.068	.061	.049	.035	.021	.014	.015	.027	.044	.053	.062	.066	.063	.048
Memphis, Tenn.	29.585	.581	.574	.572	.575	.584	.596	.609	.619	.626	.625	.624	.616	.603	.589	.575	.561	.553	.558	.568	.575	.581	.589	.594	.589
New Orleans, La.	29.964	.976	.973	.976	.981	.993	.003	.012	.022	.018	.016	.012	.003	.993	.982	.975	.970	.972	.975	.976	.990	.002	.004	.001	.992
New York, N. Y.	29.659	.657	.651	.652	.659	.667	.678	.685	.685	.684	.677	.671	.664	.656	.647	.641	.639	.640	.644	.647	.660	.665	.666	.665	.661
Philadelphia, Pa.	29.881	.878	.876	.880	.888	.893	.902	.910	.912	.910	.906	.893	.882	.872	.861	.854	.850	.853	.863	.869	.880	.888	.887	.886	.882
Pittsburg, Pa.	29.121	.120	.121	.123	.127	.139	.147	.155	.156	.153	.152	.145	.130	.120	.110	.097	.088	.086	.090	.100	.110	.117	.121	.123	.123
Portland, Oreg.	29.823	.832	.837	.841	.844	.850	.855	.860	.865	.871	.871	.870	.865	.859	.853	.845	.834	.824	.815	.806	.800	.803	.813	.825	.840
St. Louis, Mo.	29.386	.384	.385	.385	.391	.398	.408	.419	.426	.434	.427	.424	.413	.402	.390	.379	.371	.361	.362	.365	.375	.387	.391	.392	.394
St. Paul, Minn.	29.031	.032	.029	.035	.036	.041	.048	.055	.063	.063	.060	.055	.050	.043	.037	.029	.021	.012	.008	.008	.015	.025	.037	.041	.036
Salt Lake City, Utah	25.602	.603	.601	.604	.604	.608	.618	.632	.642	.649	.652	.650	.644	.638	.627	.611	.600	.595	.583	.577	.579	.582	.590	.600	.612
San Diego, Cal.	29.817	.818	.812	.804	.799	.796	.795	.798	.805	.814	.821	.821	.821	.820	.815	.811	.804	.794	.787	.782	.783	.788	.796	.804	.804
San Francisco, Cal.	29.813	.811	.809	.807	.802	.801	.803	.810	.819	.825	.832	.831	.833	.832	.824	.819	.806	.796	.788	.778	.779	.783	.792	.804	.808
Savannah, Ga.	29.977	.972	.971	.974	.983	.995	.009	.016	.017	.017	.010	.998	.981	.962	.940	.940	.937	.943	.951	.957	.972	.984	.989	.987	.979
Washington, D. C.	29.896	.893	.893	.897	.909	.917	.927	.931	.932	.929	.923	.915	.907	.894	.882	.873	.866	.864	.869	.874	.889	.896	.900	.902	.899

TABLE VI.—*Average wind movement for each hour of seventy-fifth meridian time, June, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	8.5	8.0	7.8	6.8	7.3	6.7	6.0	7.2	8.4	9.9	10.3	10.3	11.2	11.3	10.8	11.0	11.1	11.0	11.7	11.2	10.5	9.4	8.6	8.8	9.3
Albany, N. Y.	5.0	4.9	4.6	4.5	4.5	5.3	6.0	6.5	7.9	8.3	8.6	8.5	9.3	8.9	9.1	9.0	8.0	7.2	6.5	5.1	5.1	4.5	4.6	4.5	6.5
Alpena, Mich.	5.0	4.4	5.0	5.9	6.0	6.9	6.7	7.2	9.0	9.2	10.3	10.8	11.5	11.9	12.7	12.2	12.1	11.3	10.7	8.1	6.3	6.1	6.0	5.2	8.4
Amarillo, Tex.	15.1	16.2	15.2	16.1	15.7	14.8	13.1	12.2	13.9	16.2	16.4	15.2	14.7	14.4	14.5	15.1	16.0	15.7	16.4	15.7	14.0	13.8	14.8	16.3	15.0
Atlanta, Ga.	6.9	7.1	7.0	7.0	7.2	7.0	6.8	7.4	7.4	7.6	8.3	8.6	9.0	8.9	9.2	9.2	8.7	8.4	7.3	6.1	6.4	7.0	7.7	7.1	7.6
Atlantic City, N. J.	9.5	9.5	9.5	9.7	9.6	10.1	10.9	11.3	12.0	12.0	12.1	12.1	12.6	12.1	11.7	11.5	11.0	10.3	9.8	9.3	8.6	8.9	9.2	9.0	10.5
Augusta, Ga.	4.6	4.3	3.9	3.4	3.4	2.8	3.4	4.9	5.9	6.3	6.4	6.6	7.4	8.0	8.1	7.6	7.8	8.2	7.1	6.5	5.9	5.8	4.6	4.3	5.7
Baker City, Oreg.	3.6	4.1	4.5	4.7	4.9	6.0	5.6	5.7	5.2	3.7	2.9	3.5	4.7	4.7	5.6	6.9	7.6	8.6	7.8	8.1	7.5	6.0	5.4	4.3	5.5
Baltimore, Md.	3.9	3.7	3.6	3.2	3.3	3.4	3.9	4.4	5.6	6.0	6.2	6.7	7.0	7.3	7.4	7.3	7.3	6.8	6.0	5.1	5.0	4.0	4.0	3.8	5.2
Bismarck, N. Dak.	8.3	8.2	8.4	8.8	8.8	8.4	9.0	9.7	10.9	11.8	11.2	13.0	13.5	13.6	13.6	13.6	13.6	13.1	13.1	11.3	9.9	8.9	8.3	7.9	10.7
Block Island, R. I.	11.6	12.0	12.2	12.1	11.7	12.6	12.4	12.8	12.8	13.8	13.6	14.0	14.5	15.6	15.2	15.5	15.8	15.4	14.3	13.7	12.4	13.2	12.7	12.2	13.4
Boston, Mass.	9.2	9.5	9.6	9.3	8.7	9.0	9.9	10.0	11.0	12.0	12.5	12.4	12.9	13.1	13.3	13.2	12.7	11.7	11.0	10.1	9.9	10.0	9.3	8.8	10.8
Buffalo, N. Y.	9.9	10.8	11.3	11.5	11.9	12.3	12.6	13.2	14.5	14.8	14.8	14.8	15.4	14.9	15.7	15.5	15.7	15.1	15.0	12.8	11.5	11.2	11.2	10.4	13.2
Cairo, Ill.	4.9	5.1	5.3	6.1	5.4	5.4	5.2	5.7	6.1	6.4	6.6	7.5	7.9	7.7	8.5	9.1	9.0	8.4	7.6	6.3	5.4	5.3	5.0	4.9	6.4
Cape Henry, Va.	12.1	12.6	12.1	12.1	12.1	12.2	12.7	13.2	13.1	13.1	13.4	13.1	12.3	12.6	13.0	12.9	13.0	12.5	12.3	11.9	10.9	10.4	11.1	11.9	12.4
Carson City, Nev.	9.1	8.7	7.7	7.0	6.2	4.9	5.1	4.1	3.6	3.2	4.1	5.0	6.3	8.5	10.0	11.7	13.6	14.8	15.6	14.5	13.7	13.0	11.2	9.1	8.8
Charleston, S. C.	9.1	8.1	7.9	7.5	7.3	7.1	7.5	8.9	9.0	9.1	9.0	10.1	11.8	13.5	15.0	15.1	14.8	13.3	12.3	11.3	10.6	10.5	10.1	9.7	10.4
Charlotte, N. C.	5.4	5.0	5.4	5.7	5.5	5.3	5.3	6.5	7.2	6.9	6.8	6.2	6.8	7.5	7.8	7.8	8.2	7.1	6.7	5.7	5.0	5.1	5.4	5.4	6.2
Chattanooga, Tenn.	3.1	3.7	4.1	2.7	4.1	3.8	3.9	4.6	6.3	7.3	7.6	7.3	7.9	8.1	8.6	8.6	8.3	7.7	7.5	5.8	4.8	3.9	4.2	3.8	5.8
Cheyenne, Wyo.	7.6	7.5	6.9	6.7	6.1	5.7	5.4	5.6	5.7	7.9	9.8	10.8	12.2	12.4	13.1	13.6	14.4	13.6	12.4	12.5	11.8	10.0	8.5	7.8	9.5
Chicago, Ill.	14.8	14.6	14.9	15.0	14.9	15.6	14.9	14.4	14.1	14.9	14.6	14.9	16.1	16.7	17.0	17.0	16.8	16.5	16.0	15.4	14.5	14.0	13.9	14.7	15.3
Cincinnati, Ohio.	4.4	4.5	3.9	3.8	3.6	3.1	3.8	5.2	6.1	7.3	7.8	8.5	8.2	9.1	9.9	9.4	9.3	8.9	8.6	6.7	5.6	5.3	4.3	4.4	6.3
Cleveland, Ohio	11.8	12.4	12.2	11.8	11.4	11.3	10.3	10.7	11.7	12.0	12.1	13.0	13.5	13.5	13.2	12.9	13.0	12.3	11.2	10.8	10.2	11.1	11.0	11.3	11.9
Columbia, Mo.	5.7	5.3	5.5	5.4	5.0	5.1	5.0	5.8	6.7	6.7	7.6	7.4	7.6	7.2	7.2	7.3	7.5	7.0	6.2	4.8	5.0	5.1	5.5	5.8	6.1
Columbus, Ohio	4.9	5.1	5.1	4.8	4.2	4.8	4.9	5.3	6.1	7.4	7.9	8.1	8.4	8.6	8.9	8.9	9.1	9.0	8.0	6.4	5.8	5.9	5.7	5.0	6.6
Concordia, Kans.	5.4	5.3	4.6	4.7	4.8	4.5	4.5	5.7	7.2	8.3	8.1	9.0	8.8	9.0	8.9	9.2	9.0	8.6	8.5	7.5	5.5	4.4	4.9	5.8	6.8
Corpus Christi, Tex.	14.7	13.5	11.7	10.1	9.0	8.8	8.3	7.7	8.5	10.0	10.7	12.4	14.7	16.0	16.5	17.1	16.8	17.7	18.3	17.9	17.5	16.9	16.0	15.5	13.6
Davenport, Iowa.	5.0	5.5	5.0	5.1	5.5	4.9	5.6	6.7	7.4	8.0	8.6	8.8	9.1	9.3	9.3	8.9	8.4	8.6	7.8	6.5	5.0	5.0	5.1	4.8	6.8
Denver, Colo.	6.6	6.3	6.6	7.3	6.7	6.1	5.8	5.1	5.0	4.7	6.2	6.6	7.6	7.9	8.5	9.7	11.5	11.0	11.0	10.8	10.0	9.3	8.1	7.1	7.7
Des Moines, Iowa.	5.6	5.6	5.8	5.9	6.0	5.8	5.4	6.7	7.5	8.7	9.4	10.3	11.0	11.3	11.2	10.8	10.9	10.2	9.1	7.7	6.7	5.7	5.4	5.3	7.8
Detroit, Mich.	6.8	7.1	7.1	6.7	6.9	6.5	6.8	7.1	8.5	9.1	9.8	10.9	11.6	12.0	11.7	11.0	10.6	9.5	8.7	7.6	7.1	6.9	6.9	6.9	8.5
Dodge, Kans.	10.3	10.2	9.5	9.2	8.4	7.8	7.5	8.0	10.8	11.8	12.6	13.1	12.8	13.4	14.1	14.2	14.7	14.5	14.2	13.1	12.2	10.6	10.8	11.0	11.4
Dubuque, Iowa.	4.8	4.8	5.3	5.3	5.2	4.9	5.1	6.3	7.0	7.8	8.2	8.4	8.9	9.1	9.4	9.0	8.8	8.3	7.5	6.0	5.5	5.3	4.9	4.9	6.7
Duluth, Minn.	7.6	7.7	8.0	8.5	8.6	8.3	7.6	7.3	7.6	9.1	9.3	10.8	11.0	11.2	11.4	11.1	11.6	10.6	9.6	8.1	7.3	6.9	7.3	7.9	8.9
Eastport, Me.	7.4	7.4	6.8	6.6	6.6	7.4	7.3	6.9	7.6	8.7	9.6	11.0	10.5	11.2	11.2	10.8	10.7	9.2	9.5	8.3	7.7	7.5	7.4	7.6	8.5
El Paso, Tex.	10.0	10.2	8.8	9.0	10.2	9.2	7.9	8.0	8.6	8.6	9.1	9.2	9.7	10.0	10.9	10.8	11.6	10.9	12.1	12.2	11.2	10.0	10.9	10.5	10.0
Erie Pa.	7.3	8.0	8.1	7.9	8.6	8.7	8.4	9.3	9.6	10.0	10.8	10.6	11.2	10.7	11.1	10.9	10.0	9.1	7.4	7.1	6.8	7.2	7.4	7.8	8.9
Eureka, Cal.	7.4	7.9	7.9	7.2	6.2	5.2	4.9	5.4	5.0	5.2	5.2	6.4	8.3	9.8	10.8	12.1	12.8	12.9	13.1	13.2	11.9	11.1	10.0	8.6	8.7
Evansville, Ind.	4.6	4.8	4.9	4.6	4.7	4.7	5.1	6.1	6.4	7.0	7.5	8.2	8.4	8.6	8.5	8.7	9.2	8.8	8.4	6.6	5.6	5.0	5.0	4.5	6.5
Fort Canby, Wash.	13.3	12.9	12.1	12.1	10.6	9.7	10.1	11.3	12.3	11.9	11.8	12.2	13.0	12.3	12.4	11.8	11.2	12.2	13.1	13.3	13.8	13.6	13.1	12.2	12.2
Fort Smith, Ark.	3.3	4.0	4.0	4.1	4.3	4.1	4.1	4.6	5.2	5.8	6.0	5.9	6.5	7.2	7.2	7.5	7.7	7.9	6.5	5.6	4.3	4.7	3.8	4.1	5.3
Fresno, Cal.	10.1	10.2	10.0	8.9	8.4	7.9	7.2	6.4	5.6	6.0	6.1	6.0	6.2	5.8	5.6	5.7	6.3	6.3	6.8	7.2	7.8	8.5	8.3	9.1	7.4
Galveston, Tex.	9.0	9.1	8.9	8.4	8.4	7.7	7.4	7.5	8.0	8.2	8.6	9.5	9.4	10.2	10.5	10.8	11.1	10.9	10.1	10.2	9.6	9.3	9.2	9.0	9.2
Grand Haven, Mich.	6.9	6.5	6.8	6.8	6.7	6.5	7.2	8.5	9.6	9.6	10.2	10.5	11.0	11.6	11.4	10.8	10.0	9.3	8.4	7.4	7.3	6.4	6.5	6.5	8.4
Green Bay, Wis.	5.3	5.0	4.7	4.7	4.8	5.4	5.4	5.9	7.2	8.6	8.5	8.6	9.6	9.5	10.2	9.6	9.4	8.6	8.2	7.6	6.8	5.7	5.7	5.7	7.1
Hannibal, Mo.	6.5	6.0	5.9	6.0	5.8	5.3	5.5	6.0	7.5	8.7	9.1	9.7	10.2	10.0	10.1	10.4	9.7	8.7	8.4	6.7	5.6	5.9	5.5	6.0	7.5
Harrisburg, Pa.	4.1	3.9	3.7	3.7	3.6	4.0	4.7	5.4	6.2	7.2	7.7	8.2	8.8	8.9	8.7	9.6	9.5	9.0	7.2	6.1	5.4	4.9	5.1	4.1	6.2
Hatteras, N. C.	11.5	12.3	11.9	11.6	12.1	12.4	12.5	13.1	13.5	14.1	14.7	15.0	15.8	16.0	15.4	15.1	14.5	14.4	14.0	14.2	13.3	12.1	11.6	11.8	13.5
Havre, Mont.	8.4	8.4	7.9	8.3	8.1	8.3	7.6	7.9	8.9	10.5	11.5	12.5	14.1	13.4	13.3	13.2	13.6	12.5	12.9	13.6	12.0	10.5	9.4	8.4	10.6
Helena, Mont.	6.9	6.9	6.8	7.7	7.3	6.4	6.5	6.6	5.5	6.3	6.4	7.2	7.8	8.3	9.2	9.4	9.5	9.0	9.5	10.1	8.7	7.0	7.4	8.1	7.7
Huron, S. Dak.	8.9	8.4	8.7	8.6	8.5	8.5	8.9	10.5	11.7	12.0	12.9	13.3	13.8	13.6	14.1	13.8	13.0	13.0	12.6	11.5	9.7	8.8	9.2	9.0	11.0
Idaho Falls, Idaho.	7.9	8.5	8.3	7.8	7.5	7.7	7.4	7.4	8.2	9.5	9.8	10.9	11.6	12.4	13.0	13.8	14.8	15.1	14.9	14.9	13.7	11.6	10.8	8.5	10.7
Independence, Cal.	8.4	8.1	7.3	6.8	7.1	7.4	7.0	6.9	6.8	7.1	7.6	7.6	7.6	8.2	10.1	11.5	12.9	13.9	13.8	14.5	14.1	12.5	10.5	9.0	9.4
Indianapolis, Ind.	7.3	6.9	6.6	6.4	6.2	6.0	6.0	7.4	9.0	9.5	10.5	10.7	11.5	11.3	11.1	11.4	11.2	10.9	10.1	8.6	7.3	7.6	7.5	7.2	8.7
Jacksonville, Fla.	6.0	5.8	5.8	6.1	6.1	6.2	5.7	6.4	6.9	7.5	7.7	8.1	9.1	9.3	10.1	11.4	11.8	10.7	10.0	7.5	6.3	5.7	6.0	6.0	7.6
Jupiter, Fla.	6.5	6.0	5.5	5.5	4.8	5.0	4.9	5.1	6.4	8.2	9.7	10.7	11.5	13.1	13.1	12.4	11.6	10.7	10.0	9.3	8.5	8.1	7.6	7.7	8.4
Kansas City, Mo.	6.9	6.2	6.3	6.0	5.8	5.5	5.5	6.1	6.7	7.1	7.4	7.7	8.6	8.7	9.5	9.8	9.1	8.7	8.0	7.1	6.3	6.3	6.9	6.7	7.2
Keokuk, Iowa.	5.1	5.2	4.8	5.2	4.7	4.4	4.7	5.9	6.5	7.1	7.8	8.3	7.6	8.4	8.5	8.5	8.5	7.6	7.0	5.5	5.0	5.1	5.3	5.4	6.3
Key West, Fla.	7.8	7.0	6.3	6.0	6.0	6.0	6.8	8.0	9.4	9.6	9.8	10.1	10.3	10.2	10.0	10.0	9.9	9.1	8.7	8.6	8.2	8.8	8.8	8.3	8.5
Kittyhawk, N. C.	13.1	13.7	14.2	14.6	14.8	14.8	16.0	16.8	16.7	16.6	15.9	14.7	14.5	14.0	14.1	14.3	14.9	15.5	14.9	14.6	14.2	14.2	13.6	13.4	14.8
Knoxville, Tenn.	4.5	4.6	4.4	4.4	4.6	4.7	5.5	5.9	6.9	7.3	7.7	8.4	9.2	9.1	9.4	9.2	8.6	9.2	8.2	7.7	6.4	6.1	5.0	4.5	6.7
La Crosse, Wis.	4.6	4.2	4.9	4.9	4.8	4.7	5.3	5.3	5.9	6.5	6.9	7.1	7.9	8.6	8.9	8.9	9.0	8.5	7.8	7.0	5.3	4.9	4.5	5.0	6.3
Lander, Wyo.	5.4	4.2	3.9	3.5	3.0	3.0	2.5	2.3	2.4	3.4	4.3	4.0	4.7	5.2	5.6	6.5	6.9	7.3	7.1	6.9	5.7	5.9	6.7	5.8	4.8
Lexington Ky.	8.0	7.5	7.6	6.9	7.2	7.6	7.4	7.9	8.5	9.1	9.6	9.8	10.5	9.6	9.7	9.6	9.9	9.6	8.3	6.6	6.5	7.3	7.7	8.0	8.3
Little Rock, Ark.	3.9	3.5	3.7	3.7	3.6	3.7	4.2	4.5	5.9	6.3	6.5	7.3	7.5	7.7	8.7	8.9	8.5	7.6	7.6	5.8	4.9	4.6	4.0	3.7	5.7
Los Angeles, Cal.	2.3	2.4	2.2	2.2	1.8	1.9	1.8	1.7	1.9	2.1	2.5	3.2	3.9	4.8	6.2	7.8	8.7	8.8	8.8	8.4	7.3	5.7	4.4	3.4	4.3
Louisville, Ky.	4.5	4.5	4.5	4.5	5.0	4.7	5.0	6.0	6.9	7.5	8.6	9.3	9.4	9.4	10.3	10.4	10.9	9.8	8.5	7.1	6.4	5.4	5.8	4.8	7.0
Lynchburg, Va.	2.1	2.2	2.2	2.0	1.9	2.0	2.3	3.5	4.4	5.0	5.3	5.7	5.7	5.6	5.4	5.3	5.6	5.0	4.7	3.1	2.2	2.1	1.9	1.9	3.6
Marquette, Mich.	8.6	9.2	9.4	9.3	9.1	8.8	8.9	9.4	9.7	10.3	10.5	10.6	10.6	10.6	11.5	10.4	10.0	9.4	7.3	5.8	5.2	5.3	6.1	7.2	8.9
Memphis, Tenn.	6.9	6.7	6.8	7.2	7.2	6.3	6.6	7.2	7.4	7.4	7.3	8.4	9.4	10.3	9.1	9.0	9.0	9.4	9.6	8.0	6.2	6.7	6.6	6.9	7.7
Milwaukee, Wis.	7.4	6.9	6.9	6.5	6.2	5.9	6.3	7.6	8.3	8.7	9.3	9.7	11.2	11.1	11.3	11.1	10.6	10.4	9.7	8.4	7.3	7.0	7.2	7.1	8.4
Mobile, Ala.	4.4	4.4	3.9	3.5	3.8	3.2	3.2	4.0	5.3	6.4	6.7	7.8	9.7	10.4	12.1	11.9	11.9	10.5	9.2	7.4	5.8	5.5	4.8	4.3	6.7
Montgomery, Ala.	5.6	4.9	4.6	4.3	4.2	3.7	3.8	4.6	5.7	6.1	6.7	6.9	7.5	8.0	8.3	8.6	8.3	7.9	7.8	7.9	6.8	6.5	6.5	5.7	6.3
Moorhead, Minn.	8.0	8.6	8.6	8.4	8.2	8.6	8.3	9.3	9.6	10.5	10.9	11.9	12.6	13.4	13.6	13.0	12.2	11.5	11.0	9.9	8.6	7.7	7.7	7.5	10.0
Nantucket, Mass.	9.4	9.5	9.8	10.1	10.6	10.8	11.2	11.9	12.7	13.4	13.5	13.0	12.6	12.9	12.7	12.7	12.4	11.8	10.5	10.0	9.8	9.6	9.1	9.5	11.2
Nashville, Tenn.	3.6	3.6	4.1	3.7	3.2	3.1	3.1	4.4	6.0	6.8	7.2	7.3	7.6	8.0	8.1	8.2	8.3	8.2	8.6	6.6	5.4	4.1	3.9	3.4	5.7
New Haven, Conn.	6.9	7.2	7.4	6.9	6.6	6.6	8.1	9.3	8.8	10.4	11.5	12.2	12.6	12.9	13.1	12.8	12.3	10.9	8.8	8.4	8.1	7.7	7.1	6.7	9.4
New Orleans, La.	4.9	5.3	4.8	4.3	4.2	4.0	3.9	4.7	6.2	7.4	8.0	8.3	9.3	9.7	10.7	9.7	9.6	9.3	7.8	6.4	5.8	5.4	5.0	4.6	6.6
New York, N. Y.	9.8	10.3	10.2	10.3	9.6	9.6	10.3	10.0	9.4	10.5	10.8	11.6	13.1	12.1	12.8	13.0	13.1	12.1	12.3	11.2	11.2	9.8	9.4	9.4	10.9
Norfolk, Va.	7.1	7.0	6.7	6.8	6.8	6.7	7.2	8.3	8.4	8.8	8.2	8.3	8.2	8.3	8.8	8.6	8.3	8.7	7.5	6.7	6.5	6.7	7.5	7.0	7.6
Northfield, Vt.	5.9	5.7	5.5	5.9	5.5	5.8	5.6	7.3	8.7	9.4	10.4	10.6	10.9	10.9	10.4	10.2	9.3	8.6	6.6	5.7	6.3	6.2	6.2	5.7	7.6
North Platte, Nebr.	8.3	7.5	8.3	7.7	7.5	6.9	6.6	6.7	7.6	8.1	8.9	9.3	9.5	10.4	10.8	11.0	11.5	11.3	11.4	11.1	10.0	9.2	9.0	9.8	9.1
Oklahoma, Okla.	8.3	8.2	8.0	8.0	8.6	7.8	7.1	8.1	10.2	10.9	11.2	11.1	10.8	11.7	12.1	12.9	12.3	12.1	11.2	10.5	8.5	8.2	8.1	7.7	9.7
Omaha, Nebr.	5.4	5.8	5.6	5.2	5.6	6.0	6.2	6.5	7.7	8.7	9.5	9.0	10.3	10.2	10.4	10.1	9.4	9.5	9.1	8.4	7.1	6.0	5.8	5.3	7.6
Oswego, N. Y.	7.2	7.2	7.4	7.6	8.0	7.9	8.7	9.1	9.4	9.9	10.4	10.1	10.5	10.2	9.6	9.3	8.2	7.6	6.9	6.8	6.6	6.9	6.7	7.0	8.3

TABLE VI.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Palestine, Tex	5.6	4.9	4.8	4.2	4.1	4.3	4.0	4.2	5.4	6.6	7.0	7.0	7.1	7.3	7.3	7.2	6.8	6.1	6.5	5.7	5.2	4.9	5.3	5.4	5.7
Parkersburg, W. Va.	3.6	3.0	2.8	2.7	2.8	3.2	3.3	3.9	4.5	5.6	5.5	6.2	6.8	6.7	7.1	6.7	6.8	6.4	5.6	4.6	3.7	4.2	4.1	3.7	4.7
Pensacola, Fla	6.2	5.8	5.9	5.5	5.2	5.6	6.0	5.9	6.6	6.8	7.6	8.3	9.7	10.8	11.9	12.9	12.3	11.8	11.1	10.0	8.5	7.4	6.7	6.2	8.1
Philadelphia, Pa	8.3	8.0	7.8	8.0	8.0	8.2	8.2	9.6	9.6	10.0	9.9	9.9	11.2	11.1	11.2	12.0	11.6	11.3	10.3	9.5	9.2	8.4	8.2	8.4	9.5
Phenix, Ariz	3.6	3.4	3.4	3.2	3.2	3.2	3.2	3.4	2.9	3.2	3.4	3.5	3.9	4.3	5.0	5.2	5.6	5.5	6.4	5.7	4.5	4.0	4.6	4.0	4.1
Pierre, S. Dak	10.2	8.7	7.5	7.0	7.2	6.5	6.9	7.6	8.7	10.1	10.8	11.1	11.7	11.9	12.1	11.3	11.7	12.4	12.7	12.2	11.7	10.3	10.3	11.0	10.1
Pittsburg, Pa	4.2	4.2	3.7	3.7	3.8	4.1	4.4	4.9	5.8	6.5	6.6	6.7	7.0	7.4	7.7	7.4	7.3	7.2	6.7	6.3	6.1	5.0	4.8	4.8	5.7
Port Angeles, Wash.	5.7	5.6	5.4	4.9	4.9	4.7	4.4	4.3	4.1	3.6	4.7	5.4	6.6	6.1	6.1	6.3	7.2	7.6	8.2	8.0	8.1	7.1	5.5	4.7	5.8
Port Huron, Mich	7.5	8.2	7.2	7.7	7.7	7.5	7.2	8.5	9.7	10.9	11.3	11.7	11.3	12.5	11.8	12.2	11.2	10.6	10.1	8.8	8.4	7.8	8.1	7.5	9.4
Portland, Me	5.3	5.2	5.8	5.8	5.7	5.7	6.1	6.6	7.8	8.3	8.5	8.6	9.0	9.5	9.6	8.6	8.8	8.1	6.8	5.9	5.4	5.1	5.0	5.2	6.9
Portland, Oreg	8.9	8.3	7.5	6.7	6.5	6.1	6.4	6.1	5.4	5.3	6.5	7.6	7.9	8.1	9.3	9.4	10.2	10.6	10.9	10.6	10.0	10.4	9.7	8.8	8.2
Pueblo, Colo	6.5	6.0	5.0	4.9	4.5	4.7	5.3	5.5	5.7	5.2	5.8	6.2	7.3	8.9	9.3	11.1	11.1	11.7	11.6	12.7	11.9	9.9	8.3	6.8	7.7
Raleigh, N. C	4.5	4.4	4.9	4.4	4.4	4.5	5.3	7.0	7.2	7.4	7.0	7.1	7.3	7.6	7.3	7.8	7.6	7.4	6.6	4.8	4.5	4.8	4.9	4.9	6.0
Rapid City, S. Dak	6.4	6.9	6.4	6.2	6.1	5.8	5.8	5.7	5.9	7.9	9.5	10.4	11.1	11.1	11.1	11.1	11.1	10.4	10.2	9.5	8.7	7.2	6.8	6.4	8.2
Red Bluff, Cal	8.0	8.1	8.0	7.0	6.3	6.2	5.8	4.9	5.0	5.9	7.1	6.9	7.2	7.6	8.2	8.0	8.5	8.1	8.6	9.2	9.2	9.1	8.5	8.1	7.5
Richmond, Va	4.8	4.5	4.5	4.6	5.4	5.0	5.6	6.5	6.6	7.3	7.4	7.1	7.0	7.7	8.4	7.9	8.1	6.7	5.6	5.3	5.1	4.8	4.9	4.8	6.1
Rochester, N. Y.	6.1	5.8	5.9	6.2	6.4	6.6	7.1	7.7	8.9	9.2	10.1	10.3	10.7	11.3	10.8	10.7	10.2	9.5	8.4	6.9	5.9	6.3	6.1	6.1	8.0
Roseburg, Oreg	2.6	2.5	2.2	1.8	1.6	1.9	1.9	1.6	1.6	2.1	2.5	2.8	3.4	4.2	5.1	5.3	6.2	6.8	7.0	7.5	7.8	7.2	5.3	3.8	4.0
Sacramento, Cal	10.1	10.3	10.2	10.5	10.2	9.8	9.6	9.2	8.8	8.8	9.0	9.1	9.3	9.7	10.4	10.9	11.6	12.2	12.8	13.2	13.1	12.1	12.3	11.9	10.6
St. Louis, Mo	6.7	6.5	6.3	6.3	5.9	6.2	5.9	6.2	7.1	7.6	8.7	9.4	9.8	10.6	10.5	10.2	9.6	9.4	8.5	7.3	6.3	6.2	6.0	6.7	7.7
St. Paul, Minn	5.9	5.8	5.0	4.6	5.3	5.4	5.1	5.7	6.9	7.8	8.4	8.7	9.3	10.1	10.3	10.6	9.9	9.7	8.8	7.9	6.5	6.0	6.3	6.2	7.3
Salt Lake City, Utah	4.3	5.9	5.6	5.4	4.5	4.4	4.5	4.4	3.6	4.1	5.3	7.1	8.4	9.9	10.4	10.2	10.2	10.1	9.0	7.8	6.6	5.6	5.9	4.4	6.6
San Antonio, Tex	8.6	7.9	6.9	6.3	5.5	5.1	4.9	5.0	7.2	8.6	8.3	8.6	8.9	9.6	10.1	9.4	9.3	10.3	10.4	12.0	10.7	10.9	10.8	9.6	8.5
San Diego, Cal	3.3	3.1	3.1	3.3	3.3	3.1	3.1	3.2	3.5	3.4	4.1	5.3	6.8	8.4	9.5	10.0	10.3	9.9	9.3	8.5	7.9	6.3	5.1	3.9	5.7
Sandusky, Ohio	7.6	7.3	6.8	6.8	6.9	6.7	6.7	7.3	7.6	7.4	7.9	8.3	8.7	8.6	8.6	9.5	9.4	8.0	8.0	6.8	6.7	7.1	6.7	7.8	7.6
San Francisco, Cal	11.4	10.9	9.3	9.0	8.6	8.5	7.4	7.2	7.5	7.4	8.2	9.0	9.9	12.0	15.0	18.1	19.9	20.6	21.4	21.2	21.1	20.0	17.0	13.6	13.1
San Luis Obispo, Cal.	3.1	2.6	2.3	2.2	2.2	3.0	3.4	3.6	3.5	4.1	4.4	4.8	5.6	6.6	7.8	8.8	9.7	9.5	8.9	8.4	7.5	5.8	4.6	3.5	5.2
Santa Fe, N. Mex	6.6	5.7	5.4	4.7	3.9	3.2	2.8	2.4	2.9	3.5	4.8	6.0	7.4	7.8	8.5	9.0	9.0	8.8	8.3	8.4	7.4	5.6	6.5	7.0	6.1
Sault Ste. Marie, Mich	4.1	4.0	4.4	5.1	4.6	4.9	6.1	6.9	7.6	9.4	10.6	11.8	12.6	13.4	13.4	13.7	13.5	12.2	10.1	7.8	7.3	6.3	5.0	4.1	8.3
Savannah, Ga	5.6	5.6	5.5	4.9	4.7	4.8	5.6	6.5	6.7	6.7	6.8	6.8	8.0	9.0	11.1	12.1	11.7	11.0	9.9	8.7	8.0	7.5	7.2	5.6	7.5
Seattle, Wash	4.5	4.3	3.9	4.0	3.5	3.3	3.6	3.3	3.0	3.7	4.2	5.0	5.5	6.2	6.3	6.8	6.7	7.0	6.6	6.9	6.6	6.2	5.0	4.4	5.0
Shreveport, La	5.2	5.5	5.2	4.5	4.4	4.3	4.0	4.4	5.4	5.4	5.9	6.4	7.1	7.1	7.6	7.1	7.1	7.4	6.0	5.0	5.1	5.9	6.1	5.8	
Sioux City, Iowa	9.8	9.2	9.8	9.9	9.3	9.2	8.9	8.8	9.9	11.2	12.3	13.5	14.8	14.2	14.1	15.2	14.6	14.3	13.3	11.6	11.2	11.3	11.5	11.1	11.6
Spokane, Wash	5.6	5.7	5.3	4.7	5.3	5.3	5.4	6.1	6.4	6.9	7.7	7.5	8.3	8.7	9.1	8.8	8.9	8.5	8.3	7.7	7.7	6.7	6.4	5.8	6.9
Springfield, Ill	5.5	5.7	5.3	5.7	5.3	5.3	5.4	6.8	7.1	7.4	7.8	8.0	8.9	9.2	9.3	9.4	8.8	8.7	7.5	5.7	4.7	4.8	4.8	5.7	6.8
Springfield, Mo	7.8	7.8	7.3	7.0	6.6	6.6	6.2	6.6	7.9	8.7	9.0	9.3	9.2	9.3	9.5	9.7	9.7	8.4	8.6	8.2	7.1	7.3	7.6	7.5	8.0
Tacoma, Wash	5.6	4.7	3.8	3.8	3.4	3.3	3.2	3.2	2.8	3.4	4.7	6.2	7.1	7.3	7.1	7.5	7.8	7.7	7.0	7.4	7.2	6.9	6.3	6.0	5.6
Tampa, Fla	3.9	3.9	4.2	3.7	4.0	3.8	4.2	4.9	5.6	5.8	5.9	5.5	6.9	6.4	7.9	8.1	9.1	8.4	7.7	6.7	6.3	5.5	5.0	4.2	5.7
Tatoosh Island, Wash.	8.9	10.0	10.3	10.2	9.7	9.5	9.4	8.8	9.6	9.1	9.9	10.0	9.9	10.9	10.5	10.2	10.8	10.4	10.0	10.6	11.3	11.7	11.7	10.7	10.2
Toledo, Ohio	3.8	4.0	3.9	3.8	3.8	3.9	4.2	4.0	5.2	5.7	6.3	6.8	7.6	7.5	7.3	7.2	6.8	6.8	5.7	4.3	3.6	3.8	4.0	4.0	5.2
Vicksburg, Miss	5.0	4.7	4.7	4.7	4.5	4.2	4.6	4.4	4.8	4.9	5.9	5.8	6.2	6.4	6.4	6.5	6.3	6.1	6.4	5.8	5.5	5.0	5.2	5.1	5.4
Vineyard Haven, Mass	7.8	7.9	8.2	8.5	8.8	8.8	9.0	9.9	10.7	10.6	11.0	10.9	11.7	11.4	11.7	11.4	10.9	10.0	9.2	8.4	7.8	8.1	8.2	8.0	9.5
Walla Walla, Wash	5.4	5.1	5.2	5.0	5.6	5.3	5.0	5.1	4.5	4.9	5.8	6.0	6.1	6.2	6.0	5.9	6.2	5.7	6.1	6.7	6.2	5.6	5.1	5.2	5.6
Washington, D. C	3.4	3.6	3.5	3.5	3.7	3.4	4.0	5.0	6.3	7.1	7.4	7.7	8.2	8.2	8.3	8.8	8.4	7.9	6.7	4.6	4.4	4.0	3.8	3.5	5.6
Wichita, Kans	6.2	6.0	5.9	5.7	5.5	5.8	5.9	5.7	6.4	7.0	7.6	8.2	8.1	8.5	9.1	9.4	9.3	9.3	8.2	6.8	6.5	6.4	6.7	6.5	7.1
Williston, N. Dak	7.9	7.9	7.4	7.7	7.5	7.1	7.1	7.7	9.2	11.1	10.9	10.9	11.7	11.5	11.0	12.0	11.5	10.9	11.1	11.1	10.5	9.0	8.0	8.8	9.6
Wilmington, N. C	6.0	6.5	6.2	5.6	5.6	5.5	6.9	7.9	8.4	8.1	7.8	8.1	8.6	10.5	10.9	11.7	12.1	11.5	9.6	8.4	7.8	7.0	7.0	6.6	8.1
Winnemucca, Nev	9.1	9.9	10.3	9.6	9.8	10.0	9.3	9.1	8.3	7.8	8.6	8.2	8.9	9.7	11.2	12.0	12.3	12.4	12.7	12.7	12.0	11.4	9.7	9.2	10.2
Woods Hole, Mass	12.6	12.8	13.1	12.5	12.5	11.7	12.0	14.0	14.9	15.6	16.0	15.0	16.3	16.5	15.5	15.3	15.0	13.6	13.1	12.2	11.2	11.6	11.8	12.6	13.6
Yankton, S. Dak	8.3	7.7	6.8	6.5	7.0	7.1	6.8	7.4	8.5	9.5	10.6	10.5	11.0	11.3	12.0	12.0	11.1	11.1	10.4	9.0	8.0	7.5	7.7	8.0	9.0

TABLE VII.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of June, 1898.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	17	24	14	17	s. 23 w.	8
Portland, Me	16	24	17	15	s. 14 e.	8
Northfield, Vt	25	27	5	13	s. 76 w.	8
Boston, Mass	20	13	17	24	n. 45 w.	10
Nantucket, Mass	13	21	13	25	s. 56 w.	14
Woods Hole, Mass.*	7	16	7	7	s.	9
Block Island, R. I	14	22	18	24	s. 37 w.	10
New Haven, Conn	18	23	13	16	s. 31 w.	6
Middle Atlantic States.						
Albany, N. Y	20	24	12	12	s.	4
Binghamton, N. Y.†	8	6	11	9	n. 45 e.	3
New York, N. Y	16	23	12	22	s. 55 w.	12
Harrisburg, Pa.†	8	6	6	14	n. 76 w.	8
Philadelphia, Pa	16	23	14	25	s. 58 w.	13
Atlantic City, N. J	17	16	22	20	n. 63 e.	2
Cape May, N. J	17	17	19	17	e.	2
Baltimore, Md	19	18	22	13	n. 84 e.	9
Washington, D. C	16	21	18	18	s.	5
Lynchburg, Va	20	19	20	18	n. 63 e.	2
Norfolk, Va	16	20	25	14	s. 70 e.	12
Richmond, Va	21	23	15	15	s.	2
South Atlantic States.						
Charlotte, N. C	13	20	29	10	s. 70 e.	20
Hatteras, N. C	24	26	11	8	s. 56 e.	4
Raleigh, N. C	23	18	14	19	n. 45 w.	7
Wilmington, N. C	11	26	9	30	s. 55 w.	26
Charleston, S. C	8	32	12	18	s. 14 w.	25
Augusta, Ga	11	25	19	18	s. 4 e.	14
Savannah, Ga	6	34	13	17	s. 8 w.	27
Jacksonville, Fla	12	28	22	17	s. 17 e.	17
Florida Peninsula.						
Jupiter, Fla	12	28	21	5	s. 45 e.	23
Key West, Fla	5	14	51	0	s. 81 e.	52
Tampa, Fla	17	16	32	10	n. 87 e.	22
Eastern Gulf States.						
Atlanta, Ga	14	22	12	28	s. 63 w.	18
Pensacola, Fla	9	33	8	30	s. 42 w.	33
Mobile, Ala	18	23	9	24	s. 72 w.	16
Montgomery, Ala	4	34	11	25	s. 25 w.	33
Vicksburg, Miss	5	25	30	22	s. 6 w.	30
New Orleans, La	6	39	14	17	s. 5 w.	33
Western Gulf States.						
Shreveport, La	3	35	28	16	s. 21 e.	34
Fort Smith, Ark	13	13	35	6	e.	29
Little Rock, Ark	8	30	15	15	s.	22
Corpus Christi, Tex	1	39	38	1	s. 45 e.	53
Galveston, Tex	3	47	15	9	s. 8 e.	44
Palestine, Tex	9	41	17	6	s. 19 e.	34
San Antonio, Tex	7	31	38	2	s. 56 e.	43
Ohio Valley and Tennessee.						
Chattanooga, Tenn	12	28	15	23	s. 27 w.	18
Knoxville, Tenn	26	17	17	13	n. 24 e.	10
Memphis, Tenn	11	28	14	22	s. 25 w.	19
Nashville, Tenn	20	17	15	23	n. 69 w.	8
Lexington, Ky	13	22	24	16	s. 42 w.	12
Louisville, Ky	25	21	12	17	n. 51 w.	6
Evansville, Ind.†	11	11	11	6	e.	5
Indianapolis, Ind	24	22	15	16	n. 27 w.	2
Cincinnati, Ohio	16	23	21	14	s. 45 e.	10
Columbus, Ohio	17	15	16	25	n. 77 w.	9
Pittsburg, Pa	21	19	7	24	n. 83 w.	17
Parkersburg, W. Va	19	27	13	14	s. 7 w.	8
Lower Lake Region.						
Buffalo, N. Y	12	19	14	30	s. 66 w.	18
Oswego, N. Y	15	19	12	34	s. 72 w.	13
Rochester, N. Y	19	15	15	29	n. 74 w.	15
Erie, Pa	13	19	14	24	s. 59 w.	12
Cleveland, Ohio	18	24	15	18	s. 27 w.	7
Sandusky, Ohio	12	15	21	26	s. 59 w.	6
Toledo, Ohio	14	14	17	29	w.	12
Detroit, Mich	16	23	14	22	s. 49 w.	11
Upper Lake Region.						
Alpena, Mich	18	20	19	18	s. 27 e.	2
Grand Haven, Mich	15	21	14	24	s. 59 w.	12
Marquette, Mich	23	17	11	23	n. 63 w.	13
Port Huron, Mich	25	23	10	12	n. 45 w.	3
Sault Ste. Marie, Mich	13	8	22	26	n. 39 w.	6
Chicago, Ill	17	22	18	16	s. 22 e.	5
Milwaukee, Wis	19	19	19	17	e.	2

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
Upper Lake Region—Cont'd.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Green Bay, Wis	19	21	18	13	s. 68 e.	5
Duluth, Minn	38	3	29	8	n. 31 e.	41
North Dakota.						
Moorhead, Minn	22	21	19	17	n. 63 e.	2
Bismarck, N. Dak	21	14	19	21	n. 16 w.	7
Williston, N. Dak	26	12	17	15	n. 8 e.	14
Upper Mississippi Valley.						
St. Paul, Minn	12	22	16	25	s. 42 w.	14
La Crosse, Wis.†	7	16	7	10	s. 18 w.	10
Davenport, Iowa	13	16	18	26	s. 69 w.	8
Des Moines, Iowa	13	28	15	17	s. 8 w.	15
Dubuque, Iowa	13	24	16	19	s. 15 w.	11
Keokuk, Iowa	18	23	18	16	s. 22 e.	5
Cairo, Ill	18	27	20	11	s. 45 e.	13
Springfield, Ill	15	27	16	18	s. 9 w.	12
Hannibal, Mo.†	4	13	9	9	s.	9
St. Louis, Mo	18	21	26	12	s. 78 e.	14
Missouri Valley.						
Columbia, Mo.*	6	14	11	6	s. 32 e.	9
Kansas City, Mo	15	28	27	5	s. 60 e.	26
Springfield, Mo	10	35	27	4	s. 43 e.	34
Lincoln, Nebr	16	28	20	4	s. 53 e.	20
Omaha, Nebr	20	25	18	9	s. 61 e.	10
Sioux City, Iowa†	13	10	11	5	n. 63 e.	7
Pierre, S. Dak	15	23	24	16	s. 45 e.	11
Huron, S. Dak	18	20	19	16	s. 56 e.	4
Yankton, S. Dak†	9	8	10	12	n. 63 w.	2
Northern Slope.						
Havre, Mont	13	15	20	26	s. 72 w.	6
Miles City, Mont	34	6	13	26	n. 30 w.	32
Helena, Mont	9	21	8	35	s. 66 w.	30
Rapid City, S. Dak	16	13	20	23	n. 45 w.	4
Cheyenne, Wyo	11	25	7	23	s. 49 w.	21
Lander, Wyo	16	17	9	30	s. 88 w.	27
North Platte, Nebr	13	26	16	13	s. 13 e.	3
Middle Slope.						
Denver, Colo	11	29	15	19	s. 13 w.	18
Pueblo, Colo	21	14	15	20	n. 36 w.	9
Concordia, Kans	16	31	16	6	s. 34 e.	18
Dodge, Kans	14	32	18	9	s. 27 e.	20
Wichita, Kans	13	35	20	8	s. 29 e.	25
Oklahoma, Okla	8	38	20	3	s. 30 e.	34
Southern Slope.						
Abilene, Tex	4	41	10	11	s. 2 w.	37
Amarillo, Tex	10	33	19	8	s. 26 e.	26
Southern Plateau.						
El Paso, Tex	19	8	33	13	n. 61 e.	23
Santa Fe, N. Mex	9	27	18	17	s. 3 e.	18
Phenix, Ariz	22	5	20	24	n. 13 w.	18
Yuma, Ariz	11	23	13	23	s. 40 w.	16
Independence, Cal	19	17	16	25	n. 77 w.	9
Middle Plateau.						
Carson City, Nev	7	19	4	40	s. 72 w.	38
Winnemucca, Nev	15	28	7	23	s. 51 w.	21
Salt Lake City, Utah	16	20	24	17	s. 60 e.	8
Northern Plateau.						
Baker City, Oreg	22	26	3	16	s. 77 w.	13
Idaho Falls, Idaho	23	32	3	7	s. 24 w.	10
Spokane, Wash	15	25	18	13	s. 27 e.	11
Walla Walla, Wash	14	26	11	16	s. 23 w.	13
North Pacific Coast Region.						
Port Canby, Wash	23	30	11	18	n. 67 w.	8
Port Angeles, Wash.*	12	0	7	18	n. 43 w.	16
Seattle, Wash	16	23	15	17	s. 16 w.	7
Tacoma, Wash	24	17	5	26	n. 72 w.	22
Tatoosh Island, Wash	6	26	13	24	s. 29 w.	23
Portland, Oreg	20	20	9	26	w.	17
Roseburg, Oreg	36	5	13	21	n. 14 w.	32
Middle Pacific Coast Region.						
Eureka, Cal	23	16	12	31	n. 70 w.	20
Red Bluff, Cal	22	23	22	10	s. 85 e.	12
Sacramento, Cal	8	39	9	23	s. 24 w.	34
San Francisco, Cal	1	20	1	50	s. 69 w.	53
South Pacific Coast Region.						
Fresno, Cal	41	2	0	38	n. 44 w.	54
Los Angeles, Cal	2	18	2	45	s. 69 w.	46
San Diego, Cal	17	20	4	29	s. 83 w.	25
San Luis Obispo, Cal	18	9	1	36	n. 76 w.	36

*From observations at 8 p. m. only. †From observations at 8 a. m. only.

TABLE VIII.—*Thunderstorms and auroras, June, 1898.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	55	T.	2	6	....	3	1	1	...	....	....	....	4	10	5	6	4	3	6	5	6	6	7	2	1	3	3	8	5	4	3	2	....	106	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arizona	56	T.	....	....	....	....	....	....	3	4	9	9	4	1	1	....	....	....	....	3	4	5	10	2	1	....	....	....	....	....	2	4	....	62	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arkansas	59	T.	9	3	9	9	6	3	7	9	1	4	9	11	11	9	10	7	5	3	10	11	15	6	6	....	3	6	5	5	1	1	....	194	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
California	180	T.	3	....	....	....	....	2	4	5	4	4	4	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	27	8	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Colorado	72	T.	....	....	4	1	6	8	11	8	6	7	15	11	20	19	10	5	15	13	15	6	2	13	2	....	2	....	....	1	3	9	....	212	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Connecticut	21	T.	....	....	....	....	....	4	....	....	....	....	3	3	8	7	....	....	....	....	....	....	....	10	....	....	6	....	....	....	....	....	....	41	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Delaware	5	T.	....	....	1	....	....	....	....	....	....	....	2	1	3	....	....	....	....	....	1	....	....	3	1	....	1	1	....	3	....	....	....	17	10	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	....	1	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	1	1	....	1	....	....	....	6	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	45	T.	4	1	....	2	8	....	....	....	...	1	7	8	11	8	5	8	13	10	6	12	14	8	5	5	7	10	9	7	2	2	....	173	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Georgia	55	T.	....	2	1	2	....	....	....	....	....	1	2	14	8	4	6	8	8	11	10	6	8	2	....	2	....	11	6	3	....	4	....	119	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Idaho	38	T.	3	1	1	2	5	6	3	3	4	8	7	4	8	3	....	1	....	3	2	....	2	1	3	1	....	....	....	....	1	...	....	72	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Illinois	86	T.	13	...	....	....	....	4	27	15	29	23	24	16	10	8	7	10	2	3	1	....	....	5	20	5	17	15	3	....	1	....	....	258	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	2	2	A.
Indiana	57	T.	....	....	....	....	....	....	12	9	8	9	10	11	9	5	1	1	1	....	1	....	....	2	1	11	9	1	....	....	....	....	....	101	17	T.
		A.	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Indian Territory	7	T.	1	....	1	2	1	....	2	1	2	1	1	1	....	....	1	....	....	....	1	....	....	....	....	....	1	2	....	....	....	....	18	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Iowa	120	T.	2	....	5	12	7	8	8	2	17	8	3	10	7	2	1	2	9	14	....	....	4	14	2	15	12	3	....	5	9	9	....	190	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kansas	85	T.	3	....	4	6	5	11	3	7	8	1	12	5	1	11	11	1	....	12	4	....	9	...	3	1	6	7	....	....	....	....	....	131	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kentucky	48	T.	....	....	....	....	....	1	1	6	9	9	5	10	3	5	3	6	6	5	8	....	....	....	....	2	9	14	12	3	....	....	....	117	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	46	T.	8	7	7	7	5	7	5	1	1	5	5	4	6	12	11	9	6	7	3	6	5	10	4	6	2	10	10	11	8	6	....	194	30	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	18	T.	....	....	....	....	....	....	8	....	....	1	....	1	....	....	....	....	....	....	....	....	2	....	....	....	3	....	....	....	....	....	....	14	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Maryland	40	T.	....	2	3	....	....	....	....	....	....	1	12	5	10	1	....	....	....	1	1	....	....	2	....	....	9	3	3	7	....	1	...	61	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Massachusetts	59	T.	....	....	1	....	....	1	....	....	....	...	....	2	4	1	....	....	....	1	2	....	....	7	....	...	9	....	....	1	....	....	....	29	10	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1	A.
Michigan	104	T.	10	2	1	1	1	1	8	1	1	10	16	19	14	3	..	1	3	6	....	3	....	....	....	18	17	....	1	....	12	3	....	152	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	2	2	A.
Minnesota	67	T.	7	4	9	11	12	3	1	....	1	5	1	....	5	....	....	....	30	2	....	....	1	2	2	11	11	....	....	20	4	23	....	155	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	4	4	A.
Mississippi	43	T.	10	7	6	5	7	6	12	1	1	2	10	9	14	9	7	9	11	6	8	11	8	9	4	3	4	11	10	10	4	10	....	224	30	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Missouri	95	T.	20	2	15	20	11	11	20	24	20	12	24	17	4	23	17	12	6	16	2	2	9	9	1	6	20	34	8	....	....	2	....	367	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Montana	40	T.	2	....	2	4	...	1	1	1	5	6	5	3	4	9	1	5	2	3	6	6	1	3	3	3	....	1	2	....	1	1	....	81	26	T.
		A.	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	3	3	A.
Nebraska	144	T.	....	....	5	14	1	7	....	....	4	1	1	....	12	5	....	....	3	6	....	3	7	....	4	7	2	1	....	2	3	....	....	88	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Nevada	50	T.	2	1	....	1	1	1	1	4	5	4	7	4	1	1	....	....	....	1	1	....	....	2	1	....	....	....	....	....	....	....	....	38	17	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Hampshire	21	T.	....	....	....	....	....	2	....	13	2	....	....	4	2	3	....	....	....	....	1	2	6	....	....	6	....	....	....	....	....	....	....	41	10	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	2	2	A.
New Jersey	51	T.	....	....	....	....	....	3	....	....	....	1	11	10	10	4	....	....	....	....	6	....	1	17	1	2	22	1	....	18	1	....	....	108	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Mexico	34	T.	....	....	....	....	6	4	2	6	4	2	1	2	3	3	...	....	5	3	2	6	5	4	3	1	....	2	1	....	....	....	....	65	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	A.
New York	113	T.	....	6	....	....	....	5	5	8	1	2	30	26	14	3	..	....	....	16	23	5	2	16	....	....	24	1	5	6	....	9	....	207	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	A.
North Carolina	57	T.	....	4	....	3	....	....	....	....	....	8	....	10	15	10	18	11	6	8	10	....	7	....	....	....	4	11	10	4	3	1	....	143	18	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
North Dakota	52	T.	2	7	1	1	4	....	1	....	..	3	1	2	1	....	....	3	2	1	2	7	7	7	8	....	1	....	....	3	....	....	....	64	20	T.
		A.	....	....	....	....	....	1	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	4	4	A.
Ohio	134	T.	....	....	....	....	....	....	1	35	7	42	40	38	39	17	....	3	7	10	12	....	....	....	....	....	42	14	25	3	1	....	....	336	17	T.
		A.	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	1	....	2	....	....	1	....	....	....	....	....	....	....	6	5	A.
Oklahoma	21	T.	...	....	....	1	....	....	3	2	1	1	1	1	....	1	4	2	....	....	1	....	....	....	....	....	....	2	2	....	....	....	....	22	13	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oregon	72	T.	1	1	....	....	....	1	2	4	4	7	7	1	3	....	3	..	....	1	1	....	....	....	....	....	....	....	....	....	3	....	....	39	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Pennsylvania	105	T.	....	8	....	....	....	4	5	9	1	5	35	28	21	7	...	....	1	8	25	1	4	8	2	....	....	25	3	7	14	1	....	222	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Rhode Island	8	T.	..	....	....	....	....	....	....	....	....	....	....	3	2	2	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	9	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Carolina	40	T.	....	5	....	3	2	....	....	....	....	....	10	10	12	23	17	13	15	14	3	14	....	....	....	....	1	13	6	3	3	3	....	160	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	56	T.	....	5	6	2	....	2	2	....	1	....	1	2	6	....	2	2	6	2	2	....	1	2	1	9	....	....	2	3	3	9	....	71	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Tennessee	59	T.	....	....	....	1	....	2	5	3	6	4	6	10	12	8	8	12	13	12	12	2	2	....	....	5	8	13	13	3	....	1	....	161	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Texas	89	T.	10	6	6	7	6	3	5	8	7	13	8	7	7	6	5	4	3	....	9	1	1	1	1	1	....	8	8	4	5	3	....	153	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Utah	38	T.	...	....	....	1	1	....	....	....	5	4	6	2	3	....	....	....	....	....	....	....	....	8	2	...	....	....	....	....	....	....	....	32	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	14	T.	....	...	....	....	....	2	....	7	....	1	1	6	3	4	....	1	1	1	2	....	2	5	....	....	3	....	....	1	....	1	....	41	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	1	A.
Virginia	48	T.	....	3	3	....	....	....	....	....	1	6	4	10	12	4	9	....	....	....	8	....	1	....	....	....	9	9	6	10	1	....	....	96	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	50	T.	1	....	....	....	....	....	....	....	1	1	....	....	9	....	3	....	1	11	3	1	....	....	....	....	....	....	....	....	2	....	....	33	10	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
West Virginia	33	T.	1	....	....	....	....	....	....	1	....	3	5	6	4	4	2	....	....	2	6	....	1	....	....	....	6	4	2	1	....	....	....	48	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wisconsin	60	T.	1	2	3	4	4	1	10	1	1	16	2	6	7	4	....	....	5	1	....	1	....	1	9	17	5	1	....	3	11	4	....	120	25	T.
		A.	....	....	....	....	....	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	4	4	A.
Wyoming	17	T.	....	....	....	....	1	3	2	....	....	3	4	3	3	4	....	....	1	2	2	2	....	...	3	2	....	....	....	....	1	1	....	37	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2,871	T.	115	86	94	125	101	118	172	206	177	253	357	367	366	247	162	143	180	224	233	168	158	182	95	132	280	250	160	152	102	110	....	5,455	....	T.
		A.	0	0	0	0	0	2	3	0	0	1	2	2	1	4	1	0	1	0	1	1	1	6	0	0	4	0	1	0	4	0	....	35	....	A.

TABLE IX.—*Average hourly sunshine (in percentages), June, 1898.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	Personal estimate.
																		Hours.	*Hours.*		
Albany, N. Y	T.	66	73	84	91	99	100	99	99	98	97	95	96	94	83	73	63	410.7	459.9	89	46
Atlanta, Ga	T.	72	72	77	88	96	100	97	92	94	92	86	79	82	73	59	41	363.0	431.5	84	57
Atlantic City, N. J	P.	60	61	63	68	68	73	72	75	81	85	78	77	72	65	56	53	312.8	445.9	70	56
Baltimore, Md	T.	50	57	69	83	91	93	97	100	98	100	96	93	85	86	59	49	374.6	445.9	84	62
Binghamton, N. Y	T.	23	23	34	59	62	72	81	79	79	75	66	61	42	31	30	29	248.0	456.2	54	40
Bismarck, N. Dak	P.	40	41	44	57	62	62	67	69	66	63	68	67	55	48	52	50	271.8	475.6	57	53
Boston, Mass	T.	30	30	38	42	50	55	57	65	65	75	68	63	51	46	46	24	233.5	456.2	51	40
Buffalo, N. Y	T.	36	43	57	74	81	87	89	93	89	91	88	86	80	67	46	25	333.7	459.9	73	44
Charleston, S. C	T.	43	43	57	73	80	83	78	90	86	83	78	76	64	47	40	37	297.1	428.7	69	65
Chattanooga, Tenn	T.	49	50	55	67	72	78	73	81	81	78	75	72	69	57	30	32	287.1	434.3	66	59
Cheyenne, Wyo	P.	70	73	85	88	90	88	86	85	79	73	65	65	64	58	39	25	325.5	451.9	72	63
Chicago, Ill	T.	16	18	35	46	57	69	78	72	70	70	62	59	56	30	24	28	229.0	456.2	50	56
Cincinnati, Ohio	T.	66	65	65	68	82	89	90	93	96	97	95	93	90	79	64	59	366.3	445.9	82	65
Cleveland, Ohio	T.	46	47	60	74	77	85	89	84	87	84	85	82	70	51	46	43	322.1	456.2	71	76
Columbia, Mo	T.	46	47	56	71	79	86	90	87	90	88	89	90	83	74	67	49	341.2	445.9	77	44
Columbus, Ohio	T.	50	56	72	89	90	90	96	97	96	96	99	97	92	95	75	62	387.1	449.0	86	63
Denver, Colo	P.	77	71	80	81	89	85	84	84	79	67	59	51	41	46	33	47	302.8	449.0	67	56
Des Moines, Iowa	T.	50	49	50	57	67	75	72	72	68	69	70	67	73	72	62	58	296.2	456.2	65	62
Detroit, Mich	T.	50	51	64	77	83	82	85	86	86	81	75	75	63	57	32	21	312.1	456.2	68	56
Dodge, Kans	P.	49	54	67	71	75	77	77	78	71	72	72	69	70	63	54	52	302.3	443.1	68	60
Dubuque, Iowa	T.	23	23	31	44	58	69	79	78	83	75	75	73	67	56	36	30	263.9	456.2	58	45
Eastport, Me	P.	24	23	23	26	38	44	50	44	52	63	57	63	60	56	42	30	304.6	466.7	44	30
Erie, Pa	T.	46	47	51	69	76	81	82	82	87	87	85	78	70	52	43	40	313.3	456.2	69	54
Eureka, Cal	P.	26	28	31	44	51	55	47	50	57	63	61	58	52	47	47	48	219.2	451.9	49	44
Fresno, Cal	T.	90	90	91	96	97	98	98	96	99	96	100	99	96	90	87	37	417.5	440.2	95	88
Galveston, Tex	P.	.....	30	81	77	84	84	87	92	81	80	73	80	68	63	25	8	301.1	419.0	72	52
Helena, Mont	P.	47	49	62	69	69	73	71	72	68	68	78	58	45	47	41	33	283.0	475.6	60	57
Huron, S. Dak	T.	50	50	47	50	63	73	70	72	80	74	73	61	54	52	54	57	285.4	463.5	62	52
Idaho Falls, Idaho*	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind	T.	40	40	39	58	73	75	78	82	77	77	72	66	50	48	43	43	275.3	449.0	61	50
Jacksonville, Fla	T.	33	40	42	72	94	95	100	96	93	86	83	73	57	40	36	50	303.0	420.9	72	56
Kansas City, Mo	P.	40	38	46	55	54	62	63	59	60	70	74	70	58	52	38	45	250.3	445.9	56	45
Key West, Fla	T.	.....	34	38	66	74	87	91	89	88	88	87	84	79	60	54	.....	301.1	410.2	73	71
Knoxville, Tenn	T.	54	57	62	76	89	96	96	95	93	97	92	89	88	81	73	67	365.4	437.2	84	82
Little Rock, Ark	T.	46	48	48	57	69	82	78	70	73	82	74	69	56	41	37	39	270.7	434.3	62	33
Los Angeles, Cal	P.	23	23	22	26	42	61	77	86	91	91	91	91	93	84	80	78	293.7	431.5	68	61
Louisville, Ky	T.	53	53	57	76	82	83	88	89	95	90	86	82	71	65	56	52	333.8	443.1	75	55
Minneapolis, Minn	T.	30	21	32	48	62	70	85	86	84	69	61	65	54	38	27	31	252.6	466.7	54	.....
Nashville, Tenn	T.	55	62	72	85	88	98	98	98	98	97	95	90	88	75	56	47	369.1	437.2	84	62
New Orleans, La	T.	50	43	58	73	79	84	75	70	58	53	50	52	37	27	17	12	232.6	420.9	55	44
New York, N. Y	T.	26	32	54	64	81	86	92	98	91	93	88	81	72	60	31	22	315.0	451.9	70	54
Northfield, Vt	P.	30	35	46	49	52	50	52	60	57	57	60	49	53	43	29	27	218.8	463.5	47	35
Oklahoma, Okla	T.	46	46	55	77	90	97	98	93	97	98	95	96	87	73	66	67	358.8	434.3	83	72
Omaha, Nebr	P.	36	39	54	56	60	65	68	64	56	59	62	66	64	67	57	58	266.1	451.9	59	56
Parkersburg, W. Va	T.	38	37	38	50	63	70	81	84	83	88	80	74	73	48	38	38	281.6	445.9	63	57
Philadelphia, Pa	T.	42	42	48	71	78	81	90	94	98	96	91	78	72	54	43	41	322.6	449.0	72	47
Phenix, Ariz	P.	77	78	88	94	92	91	92	93	94	94	92	92	88	85	79	79	382.2	428.7	89	82
Pittsburg, Pa	T.	46	47	51	67	79	90	83	85	90	90	86	85	78	63	56	57	332.0	451.9	73	48
Portland, Me	T.	17	27	43	49	65	72	78	77	77	82	79	77	58	45	32	14	265.6	463.5	57	34
Portland, Oreg	T.	36	38	45	51	65	80	82	80	91	86	85	81	76	61	45	39	309.1	471.7	66	66
Raleigh, N. C	T.	56	57	64	75	80	85	86	89	84	86	80	76	66	50	31	28	310.1	437.2	71	59
Rochester, N. Y	T.	30	32	36	38	57	64	67	67	75	65	67	60	40	38	30	13	229.4	459.9	50	46
St. Louis, Mo	T.	33	34	53	79	91	90	91	90	88	88	86	87	83	69	46	33	331.1	445.9	74	46
St. Paul, Minn	P.	28	29	39	48	60	64	65	67	64	66	62	65	61	51	40	38	249.7	466.7	54	45
Salt Lake City, Utah	P.	83	85	89	88	90	87	89	89	85	90	83	86	87	80	71	64	382.8	451.9	85	66
San Diego, Cal	P.	21	20	22	26	31	51	76	87	87	84	86	80	70	59	40	33	248.4	428.7	58	72
San Francisco, Cal	T.	32	32	47	68	77	81	87	94	95	95	94	92	83	70	54	45	328.3	443.1	74	63
Santa Fe, N. Mex	P.	76	77	76	83	85	87	86	86	77	65	59	56	47	56	44	41	305.5	437.2	70	59
Savannah, Ga	P.	67	43	78	87	88	90	92	89	88	84	80	73	66	61	52	41	333.4	425.8	78	61
Seattle, Wash	T.	30	31	31	41	60	83	84	84	83	84	76	65	62	50	40	29	279.3	479.8	58	52
Spokane, Wash	T.	63	68	68	79	88	91	92	93	92	93	91	87	84	75	67	59	387.3	479.8	81	55
Tacoma, Wash	T.	27	27	36	47	61	69	75	71	73	76	67	64	56	55	30	25	256.2	475.6	54	50
Tampa, Fla	T.	.....	83	83	76	89	86	83	78	77	76	69	58	47	52	53	.....	300.8	416.2	72	70
Topeka, Kans	T.	45	47	43	46	47	48	53	64	66	59	49	45	35	44	44	54	219.7	445.9	49	.....
Vicksburg, Miss	T.	0	0	0	12	39	60	69	74	76	58	63	52	38	19	17	14	173.4	425.8	41	40
Washington, D. C	P.	63	66	70	75	75	80	79	77	69	71	75	73	76	67	52	45	314.5	445.9	71	64
Wilmington, N. C	T.	18	21	44	67	80	86	94	90	78	70	74	73	77	59	27	19	284.2	431.5	66	57
Yankton, S. Dak	T.	20	23	44	64	71	75	72	80	77	73	73	71	67	61	39	36	277.9	459.9	60	53

*Self-register out of order.

TABLE X.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during June, 1898, at all stations furnished with self-registering gauges.*

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	13	4.13 p. m.	6.15 p. m.	1.45	4.13 p. m.	4.38 p. m.	0.00	0.25	0.59	0.82	0.97	1.05									
Atlanta, Ga.	12			0.20														0.12			
Atlantic City, N. J.	28-29	5.50 p. m.	D. N.	1.59	12.52 a. m.	1.25 a. m.	0.70	0.15	0.49	0.57	0.66	0.80	0.86								
Baltimore, Md.	13			0.50														0.45			
Binghamton, N. Y.	11			0.43														0.28			
Bismarck, N. Dak.	21			0.45														0.40			
Boston, Mass.	19			0.56														0.33			
Buffalo, N. Y.	20			0.60																	
Cairo, Ill.	26-27			0.75														0.48			
Charleston, S. C.	21-22	8.17 p. m.	1.20 a. m.	1.17	8.22 p. m.	8.52 p. m.	T.	0.10	0.28	0.52	0.70	0.82	0.92								
Chicago, Ill.*	25			2.50																	
Cincinnati, Ohio	27			0.29														0.29			
Cleveland, Ohio	25			0.57														0.54			
Columbia, Mo.	7	5.27 p. m.	6.25 p. m.	1.00	5.28 p. m.	6.11 p. m.	T.	0.27	0.46	0.61	0.64	0.74	0.83	0.92	0.98	1.00					
Do.	14-15	8.25 p. m.	8.10 a. m.	2.86	9.18 p. m.	10.00 p. m.	0.03	0.14	0.52	0.81	0.94	1.05	1.21	1.37	1.41	1.43	1.45	1.47			
Do.	26	9.53 a. m.	1.25 p. m.	1.28	10.12 a. m.	10.24 a. m.	0.03	0.30	0.72	0.78	0.79										
Columbus, Ohio	8			0.48								0.46									
Denver, Colo.	3			0.19														0.17			
Des Moines, Iowa	12	5.02 p. m.	5.37 p. m.	0.66	5.02 p. m.	5.35 p. m.	0.00	0.10	0.16	0.26	0.44	0.55	0.65								
Detroit, Mich.	10	7.00 p. m.	11.30 p. m.	1.30	8.01 p. m.	8.45 p. m.	0.05	0.45	0.65	0.70	0.75	0.78	0.80	0.90	1.00	1.05					
Do.	13	1.50 p. m.	4.00 p. m.	1.53	2.24 p. m.	3.06 p. m.	0.35	0.25	0.50	0.65	0.75	0.81	0.84	0.90	1.10	1.15	1.20				
Dodge, Kans.	4	8.47 p. m.	9.12 p. m.	1.24	8.47 p. m.	9.12 p. m.	0.00	0.47	0.76	1.00	1.15	1.24									
Duluth, Minn.	2-3			0.95														0.19			
Eastport, Me.	8			0.70														0.60			
Erie, Pa.	13			0.53														0.48			
Fresno, Cal.†																					
Galveston, Tex.	30			0.33								0.33									
Hannibal, Mo.	14-15	8.20 p. m.	7.15 a. m.	0.96	4.25 a. m.	5.00 a. m.	0.18	0.26	0.46	0.53	0.56	0.58	0.61	0.65	0.68						
Do.	18	4.30 p. m.	5.05 p. m.	0.81	4.35 p. m.	4.57 p. m.	T.	0.30	0.56	0.71	0.79	0.81									
Harrisburg, Pa.	2			0.42						0.41											
Hatteras, N. C.	21			0.35					0.35												
Huron, S. Dak.	30			0.91												0.31					
Idaho Falls, Idaho*																					
Indianapolis, Ind.	13			0.31										0.29							
Jacksonville, Fla.	17	6.18 p. m.	6.45 p. m.	0.74	6.18 p. m.	6.30 p. m.	0.00	0.30	0.60	0.73											
Jupiter, Fla.	11			0.06														0.06			
Kansas City, Mo.	15-16	9.53 p. m.	D. N.	1.08	10.15 p. m.	10.35 p. m.	0.13	0.06	0.31	0.56	0.64										
Key West, Fla.	10	4.55 p. m.	7.25 p. m.	1.30	4.55 p. m.	5.55 p. m.	0.00	0.19	0.24	0.32	0.40	0.50	0.60	0.66	0.69	0.76	0.79	0.95			
Knoxville, Tenn.	26	9.40 a. m.	1.45 p. m.	1.22	9.45 a. m.	10.05 a. m.	0.03	0.22	0.52	0.78	0.86										
Lincoln, Nebr.	9			0.54								0.54									
Little Rock, Ark.	1	7.09 p. m.	8.52 p. m.	1.63	7.50 p. m.	8.40 p. m.	0.03	0.12	0.24	0.43	0.71	0.86	1.12	1.34	1.49	1.54	1.60	1.62			
Los Angeles, Cal.	10			T.																	
Louisville, Ky.	26	2.15 a. m.	8.30 a. m.	1.96	4.15 a. m.	5.00 a. m.	0.71	0.12	0.15	0.23	0.45	0.66	0.76	0.79	0.82	0.89	0.92	0.93			
Memphis, Tenn.	21	11.00 a. m.	11.25 a. m.	0.57	11.00 a. m.	11.15 a. m.	0.00	0.15	0.38	0.55											
Milwaukee, Wis.	12			0.69														0.65			
Montgomery, Ala.	13			0.21							0.21										
Nantucket, Mass.	29			0.40														0.15			
Nashville, Tenn.	15	6.30 p. m.	8.45 p. m.	1.99	6.38 p. m.	7.20 p. m.	T.	0.33	0.79	1.04	1.34	1.54	1.72	1.79	1.84	1.87	1.90	1.92			
New Orleans, La.	28	2.45 p. m.	6.30 p. m.	1.14	2.52 p. m.	3.15 p. m.	0.01	0.17	0.47	0.69	0.79	0.84									
New York, N. Y.	22			0.24											0.24						
Norfolk, Va.	17			1.54														0.59			
Northfield, Vt.	19			0.33														0.23			
Oklahoma, Okla.	8			0.53								0.37									
Omaha, Nebr.	9	12.53 p. m.	5.13 p. m.	1.34	3.38 p. m.	4.00 p. m.	0.04	0.15	0.31	0.58	0.91	0.98									
		6.15 p. m.	7.25 p. m.	0.81	6.45 p. m.	7.10 p. m.	T.	0.25	0.40	0.52	0.62	0.69									
Parkersburg, W. Va.	27	4.40 p. m.	D. N.	2.75	4.58 p. m.	5.50 p. m.	0.24	0.10	0.15	0.24	0.28	0.39	0.44	0.52	0.69	0.89	1.04	1.14			
Philadelphia, Pa.	28			0.59							0.57										
Pittsburg, Pa.	13			0.69														0.68			
Portland, Me.	12	5.05 p. m.	5.55 p. m.	0.92	5.10 p. m.	5.25 p. m.	T.	0.40	0.69	0.74	0.79	0.85	0.89								
Portland, Oreg.	18			0.21														0.16			
Raleigh, N. C.	13	6.00 p. m.	9.45 p. m.	1.71	6.55 p. m.	7.30 p. m.	0.06	0.08	0.33	0.88	0.98	1.12	1.18	1.23							
Richmond, Va.	12	4.30 p. m.	6.05 p. m.	1.00	4.45 p. m.	5.25 p. m.	0.01	0.26	0.48	0.55	0.62	0.66	0.71	0.83	0.87						
Rochester, N. Y.	27			0.18														0.13			
St. Louis, Mo.	16	2.24 p. m.	8.11 p. m.	1.28	5.14 p. m.	5.58 p. m.	0.34	0.07	0.17	0.23	0.51	0.66	0.77	0.82	0.85	0.87					
Do.	25-26	10.10 p. m.	5.45 a. m.	0.88	1.20 a. m.	2.20 a. m.	0.01	0.03	0.06	0.10	0.15	0.26	0.38	0.52	0.69	0.75	0.78	0.82			
St. Paul, Minn.	10			0.56														0.22			
Salt Lake City, Utah.	2-3			0.90														0.18			
San Diego, Cal.	10			0.02																	
San Francisco, Cal.	1			0.18														0.07			
Savannah, Ga.	13	4.55 p. m.	9.15 p. m.	0.97	5.25 p. m.	6.00 p. m.	0.05	0.07	0.30	0.48	0.60	0.68	0.74	0.77							
Do.	19	2.46 p. m.	5.40 p. m.	1.30	4.22 p. m.	4.55 p. m.	0.10	0.15	0.22	0.34	0.60	0.87	1.13	1.18							
Seattle, Wash.	15			0.35														0.28			
Spokane, Wash.	29-30			0.85														0.57			
Tampa, Fla.	1	5.40 p. m.	8.50 p. m.	2.25	5.40 p. m.	7.40 p. m.	0.00	0.13	0.27	0.40	0.45	0.49	0.50	0.53	0.59	0.62	0.65	0.91	1.41	1.79	2.03
Do.	12-13	10.00 p. m.	D. N.	1.05	10.08 p. m.	10.20 p. m.	0.05	0.22	0.46	0.53	0.58										
Vicksburg, Miss.	14	5.37 p. m.	6.25 p. m.	1.09	5.37 p. m.	6.00 p. m.	0.00	0.22	0.54	0.81	0.98	1.06									
Do.	28	7.13 p. m.	11.30 p. m.	1.27	7.13 p. m.	8.03 p. m.	0.00	0.18	0.32	0.41	0.49	0.56	0.59	0.65	0.70	0.74	0.78				
Washington, D. C.*																					
Wilmington, N. C.	21	4.37 p. m.	6.15 p. m.	1.78	4.37 p. m.	5.23 p. m.	0.00	0.10	0.21	0.53	0.79	0.92	1.05	1.18	1.44	1.69	1.73				
Yankton, S. Dak.	3-4	5.39 p. m.	6.30 a. m.	1.56	6.08 p. m.	6.33 p. m.	0.09	0.27	0.40	0.53	0.65	0.79	0.82								

* Record incomplete. † No precipitation during the month.

TABLE XI.—*Excessive precipitation, by stations, for June, 1898.*

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Evergreen				2.00	1 00	28
Goodwater				2.15	1 20	27
Lock No. 4		2.51	12-13			
Newton				1.56	1 00	18
Selma				1.75	0 55	2
Talladega				1.50	0 30	2
Arkansas.						
Conway				1.23	1 00	13
Dardanelle				1.92	1 00	14
Fulton				1.20	0 50	22
Hot Springs		2.75	13			
Jonesboro				1.44	1 15	1
Little Rock				1.62	1 00	1
Ozark	11.15	3.25	27			
Picayune		2.70	15			
Russellville				1.08	0 50	14
Warren				1.20	0 30	21
Colorado.						
Cheyenne Wells		2.76	8-9			
Lamar		2.80	14			
Florida.						
Brooksville				1.40	1 00	14
Earnestville		2.55	1	2.55	1 00	1
Fort Meade				1.52	1 05	1
Do		2.53	18	2.53	1 25	13
Do				1.96	1 15	18
Lake Butler				1.17	1 10	29
Macclenny		2.58	20	2.58	1 20	20
Plant City				1.02	0 45	23
Switzerland				1.20	1 00	25
Tallahassee				1.53	0 45	15
Tampa		2.91	1	1.30	1 00	1
Georgia.						
Fleming		2.50	16			
Fort Gaines				1.26	1 00	3
Greenbush		3.84	12	2.30	1 00	12
Lumpkin				1.14	0 30	19
Marshallville				1.31	0 30	12
Mauzy				1.15	1 00	1
Do				1.19	1 00	24
Mount Vernon		3.00	21			
Savannah				1.21	0 50	19
Waynesboro				1.00	0 45	4
Westpoint				2.26	1 50	22
Do				2.30	1 00	26
Illinois.						
Cambridge		6.50	22-23	1.35	1 00	9
Chemung		4.31	24-25			
Chicago		2.50	25			
Cobden				1.12	0 20	15
Danville				1.00	1 00	11
Dwight				1.52	1 00	25
Effingham		4.55	16			
Elgin		5.00	25-26			
Equality				1.49	1 00	26
Galva		4.14	22-23			
Lagrange		3.78	24-25			
Loami		2.85	9			
Martinsville				2.18	1 15	15
Mount Vernon		3.25	26			
Palestine				1.22	0 30	26
Peoria				1.02	1 00	8
Rantoul		3.53	8-9			
Riley		4.40	24-25			
Tilden				2.05	2 00	16
Tuscola				1.92	1 10	9
Indiana.						
Jeffersonville		2.35	25-26			
Knightstown				1.07	1 00	25
Madison		3.33	9	3.33	1 15	9
Marengo		3.17	25-26			
Princeton		3.85	26			
Terre Haute		2.96	9			
Vevay		3.00	9	3.00	2 00	9
Iowa.						
Adin		2.80	10			
Do		3.18	22			
Atlantic		2.93	21-22			
Bonaparte				1.76	1 00	8
Do		3.69	8-9	1.93	1 00	9
Centerville				1.70	1 00	7
Greenfield	12.48	2.71	9			
Larrabee		2.70	9			
Ottumwa				1.25	1 00	11
Ovid		3.00	22			
Thurman		4.65	5			
Winterset	11.13	2.53	10			
Do		3.08	23			
Kansas.						
Atchison		2.77	5			
Burlington		3.50	26			
Dodge				1.24	0 25	4
Englewood				2.30	2 00	14
Eskridge		3.81	15			
Fort Scott		3.88	27			
Gove		3.85	3-4			
Halstead		5.30	7-8			
Lebo		4.67	26			
Linn		3.60	8			
McPherson		2.32	8			

TABLE XI.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Kansas—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Manhattan				1.35	1 15	18
Morantown		2.92	26			
Mounthope		3.22	8			
Newton				1.22	1 00	8
Ulysses		2.55	14			
Wamego		2.67	8			
Kentucky.						
Ashland				1.00	0 30	14
Bardstown				1.25	0 30	13
Blandville				1.43	0 35	6
Do				2.09	1 15	15
Leitchfield		2.77	26-27			
Lexington		4.45	26-27	1.00	1 00	26
Loretto		3.18	16-17			
Lyndon		2.60	25			
Mount Sterling		2.50	16-17			
Shelbyville		3.42	26			
Louisiana.						
Abbeville	11.00	2.75	14-15			
Alexandria		2.55	30			
Bastrop		2.50	16			
Calhoun		2.50	29			
Donaldsonville				2.10	1 45	6
Do				1.00	0 50	11
Elm Hall		3.20	3	3.20	1 00	3
Do				1.30	1 10	18
Farmerville		2.60	15			
Grand Coteau	12.04					
Houma		2.94	3			
Jeanerette	12.35			1.75	1 00	1
Lafayette	13.01	3.37	12			
Lake Charles				1.00	0 30	12
Mansfield		3.57	14	3.57	2 00	14
New Iberia	13.10	3.30	11	1.75	1 30	1
Do				1.00	0 35	28
New Orleans				1.00	1 00	28
Oakridge	13.05	3.15	15			
Plain Dealing	14.56	3.02	14			
Do		6.08	16			
Plaquemine		2.95	24	2.20	1 00	24
Rayne	11.90	3.30	22			
Ruston	13.26	2.71	16			
White Sulphur Springs		3.18	29			
Maryland.						
Mardela Springs		2.68	18-19			
Michigan.						
Adrian		2.66	25			
Agricultural College		2.50	25			
Bay City		2.69	10-11			
Charlevoix		4.72	24			
Detroit				1.08	1 00	10
Do				1.41	1 00	13
East Tawas		2.70	25			
Harrisville		2.60	24-25			
Ivan				1.00	1 00	24
Lake City		3.00	29			
Luzerne		2.60	24-25			
Mancelona		2.60	24			
Petoskey		3.05	24-25			
Port Austin		2.88	24-25			
West Harrisville		4.20	25-26			
Wetmore		2.50	24			
Minnesota.						
Alexandria		2.96	4			
Koochiching		4.15	24			
Newfolden		3.01	23	1.92	0 20	23
Pine River	11.39	7.10	2-3			
Mississippi.						
Biloxi				2.22	1 30	22
Fayette	10.75	3.50	27-28			
Hazlehurst		3.25	29			
Lake				1.80	1 00	16
Do				1.48	1 00	17
Magnolia	10.08	3.08	15	1.63	1 30	21
Meridian				1.40	1 05	16
Natchez				1.35	1 00	23
Vicksburg				1.09	0 48	14
Water Valley				1.00	0 15	28
Waynesboro				1.50	1 30	21
Windham				2.14	1 14	20
Missouri.						
Appleton City		4.10	26-27			
Arthur	11.08	4.60	26			
Avalon		3.90	26	3.00	2 00	26
Bolckow		2.60	25			
Columbia				1.00	0 45	7
Do		3.18	14-15	1.47	1 00	14
Darksville		2.50	26			
Edgehill				1.83	0 35	12
Fairport	10.71	6.05	26			
Farmersville		3.40	26			
Fulton		3.68	26			
Gallatin	10.10	5.50	25-26			
Gordonville				1.60	0 30	15
Ironton		4.52	26-27			
Jefferson City		2.81	26			
Kansas City				1.24	1 00	7
Kidder	10.58	2.98	26-27	1.32	0 22	9
Lamar		3.11	11			
Lebanon		2.74	15-16			

TABLE XI.—*Excessive precipitation*—Continued.

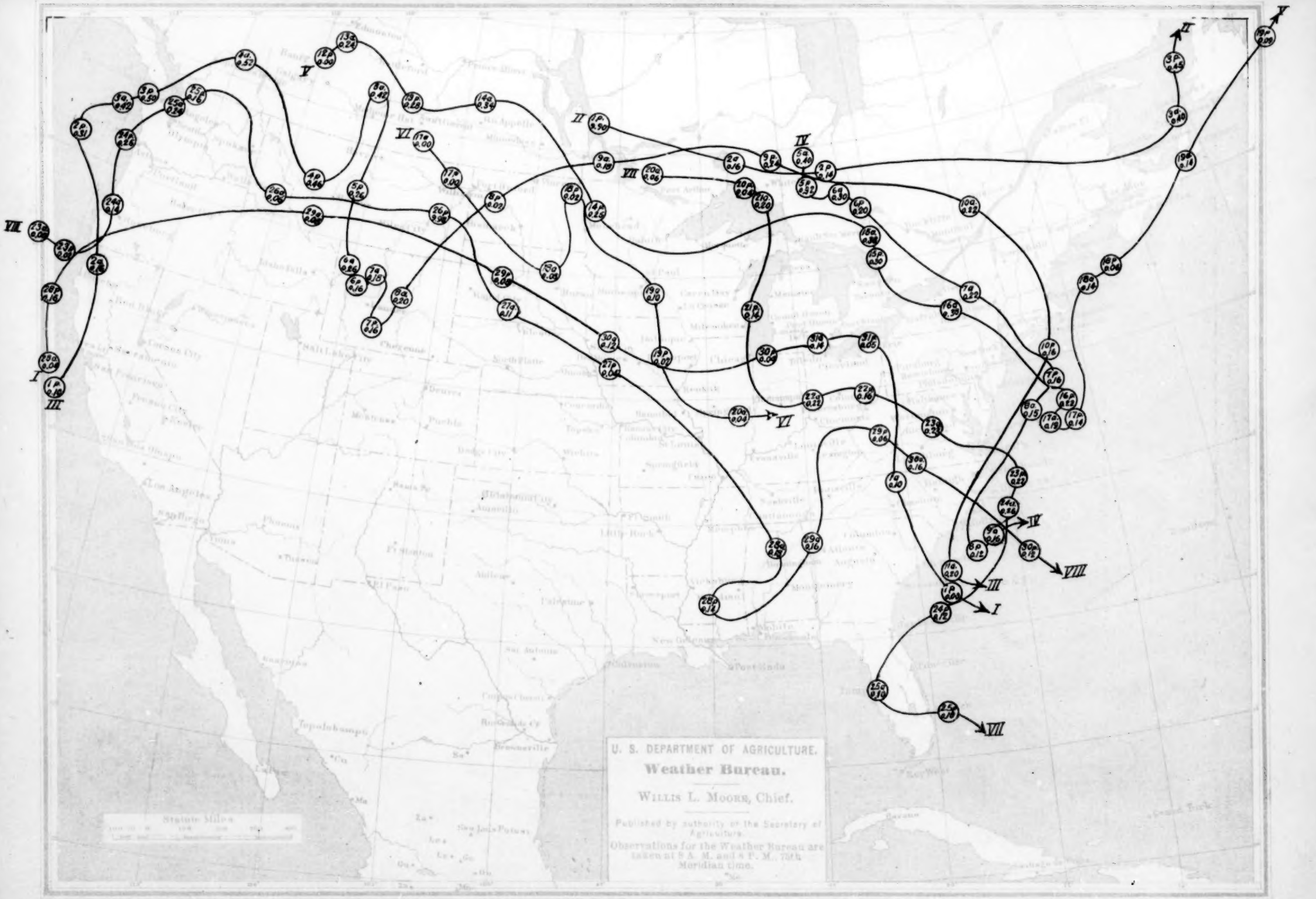
Stations.	Monthly rainfall 10 inches, or more	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Missouri—Continued.	*Inches.*	*Inches.*		*Ins.*	*h. m.*	
Malden		2.51	20			
Mansfield				1.20	1 00	26
Marshall		2.52	26			
Nevada		2.60	25-26			
New Palestine		3.02	14-15			
Oakfield		3.54	26-27			
Osceola		5.05	26-27			
Phillipsburg		3.06	15	1.03	1 00	11
Potosi		5.56	26			
Richmond				1.42	0 50	5
St. Charles		4.51	15-16	4.00	0 45	15
St. Joseph		3.07	4-5			
Sedalia		3.02	14-15			
Do		3.20	25-26			
Shelbina		2.60	26			
Unionville				1.16	0 50	7
Vichey		2.82	15			
Willow Springs		2.60	21			
Nebraska.						
Aurora		3.35	3-4			
Elba				1.00	1 00	4
Fairmont		2.65	13			
Fremont		2.63	5			
Geneva	11.62	6.25	4			
Hebron		3.06	4			
Lyons		2.51	9			
Nemaha				1.40	1 20	4
Omaha		2.94	9	1.01	0 57	9
Palmer		2.79	21			
Stanton		2.72	9			
Strang		3.75	4			
Tablerock				1.80	1 00	6
Wakefield		2.82	9			
Wisner		3.07	4			
Do		2.63	9			
New Jersey.						
Ocean City		2.50	28			
Toms River				1.75	0 45	28
New York.						
Albany				1.29	1 05	18
Humphrey				1.40	0 20	18
North Carolina.						
Asheville				1.22	0 30	17
Fayetteville				1.35	0 45	21
Monroe				1.40	0 50	18
Raleigh				1.35	1 00	13
Sloan		2.65	21	1.26	0 39	16
Do				2.65	2 25	21
Wilmington				1.75	1 00	21
North Dakota.						
Fort Yates				1.67	1 00	20
Hamilton		3.02	5			
Langdon		3.17	24			
Melville				1.80	1 10	21
Towner		3.48	23			
University		3.00	24			
Ohio.						
New Waterford		2.80	19			
Oklahoma.						
Jefferson		2.51	14			
Oregon.						
Toledo		2.50	16			

TABLE XI.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Pennsylvania	*Inches.*	*Inches.*		*Ins.*	*h. m.*	
Aqueduct				1.00	0 43	2
Elwood Junction		2.50	19			
South Carolina.						
Allendale				1.20	0 15	17
Charleston				1.02	1 00	21
Cheraw				2.18	1 30	29
Darlington (near)		3.50	29			
Pinopolis	10.68	4.18	19			
Do		4.08	21			
Shaws Fork		3.60	20-21			
Smiths Mills		2.70	15-16			
Trial		3.94	16	3.92	1 55	16
Winnsboro		3.26	16	3.26	2 35	16
South Dakota.						
Gary		2.50	30			
Goudyville		3.20	30			
Mellette		3.80	30			
Millbank		2.65	30			
Tennessee.						
Chattanooga				1.16	0 41	26
Elizabethton		3.50	18			
Erasmus				1.28	0 50	19
Milan				1.25	1 00	28
Nashville				1.92	1 00	10
New Market				2.13	2 00	26
Texas.						
Conroe				1.45	1 00	11
Estelle				1.62	1 00	5
Do				1.54	0 30	11
Fort McIntosh				1.70	1 00	10
Fruitland		2.72	7-8	2.13	1 00	13
Hale Center		2.58	15			
Hewitt				1.52	1 00	16
Junction				1.10	1 00	4
Do				1.00	1 00	8
Lampasas				1.30	1 00	13
Marshall				1.85	1 00	14
Do				2.19	1 30	30
New Braunfels				1.92	1 00	6
Palestine				1.36	1 10	12
San Antonio				1.78	0 52	11
San Marcos		2.75	11-12			
Temple				1.27	0 40	12
Vermont.						
Vernon		3.27	13			
Virginia.						
Fredericksburg				1.14	0 30	28
Lexington				2.34	1 40	15
Maidens				1.25	0 50	12
Richmond				1.00	1 03	12
Westpoint				1.20	1 00	13
West Virginia.						
Grafton				1.11	0 50	17
Parkersburg		2.96	27-28	1.44	1 10	27
Wisconsin.						
Beloit		6.55	24			
Brodhead		3.02	24			
Delavan		4.30	24			
Gratiot		6.94	24			
Meadow Valley		2.55	10			
Medford				1.80	1 40	4
Sharon		6.00	24			
Spooner		3.31	2-3			

Chart I. Tracks of Centers of

Chart I. Tracks of Centers of High Areas. June, 1898.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Weather Bureau.
WILLIS L. MOORE, Chief.
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Statute Miles

Chart II. Tracks of Centers of Low Areas. June, 1898.

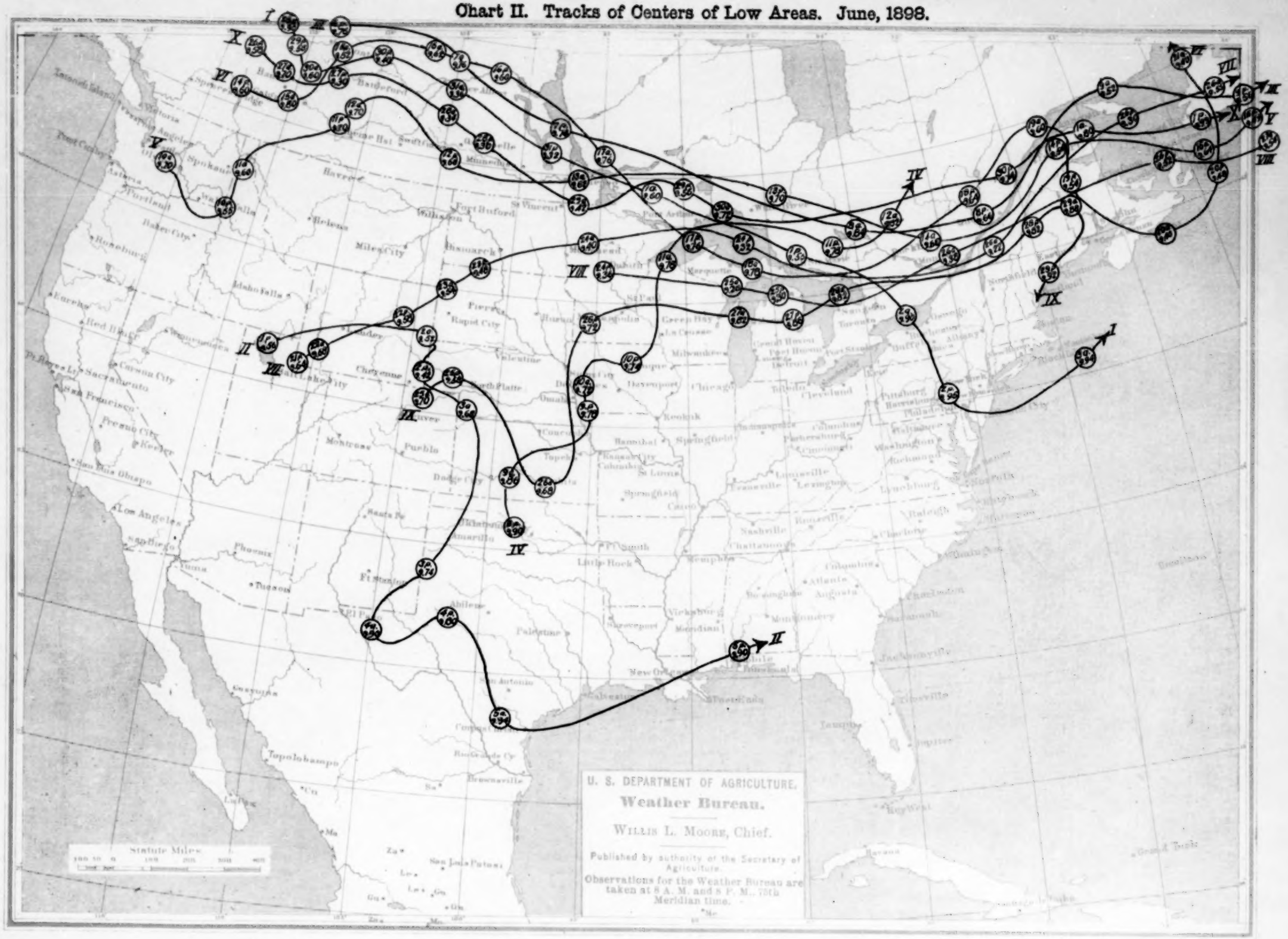
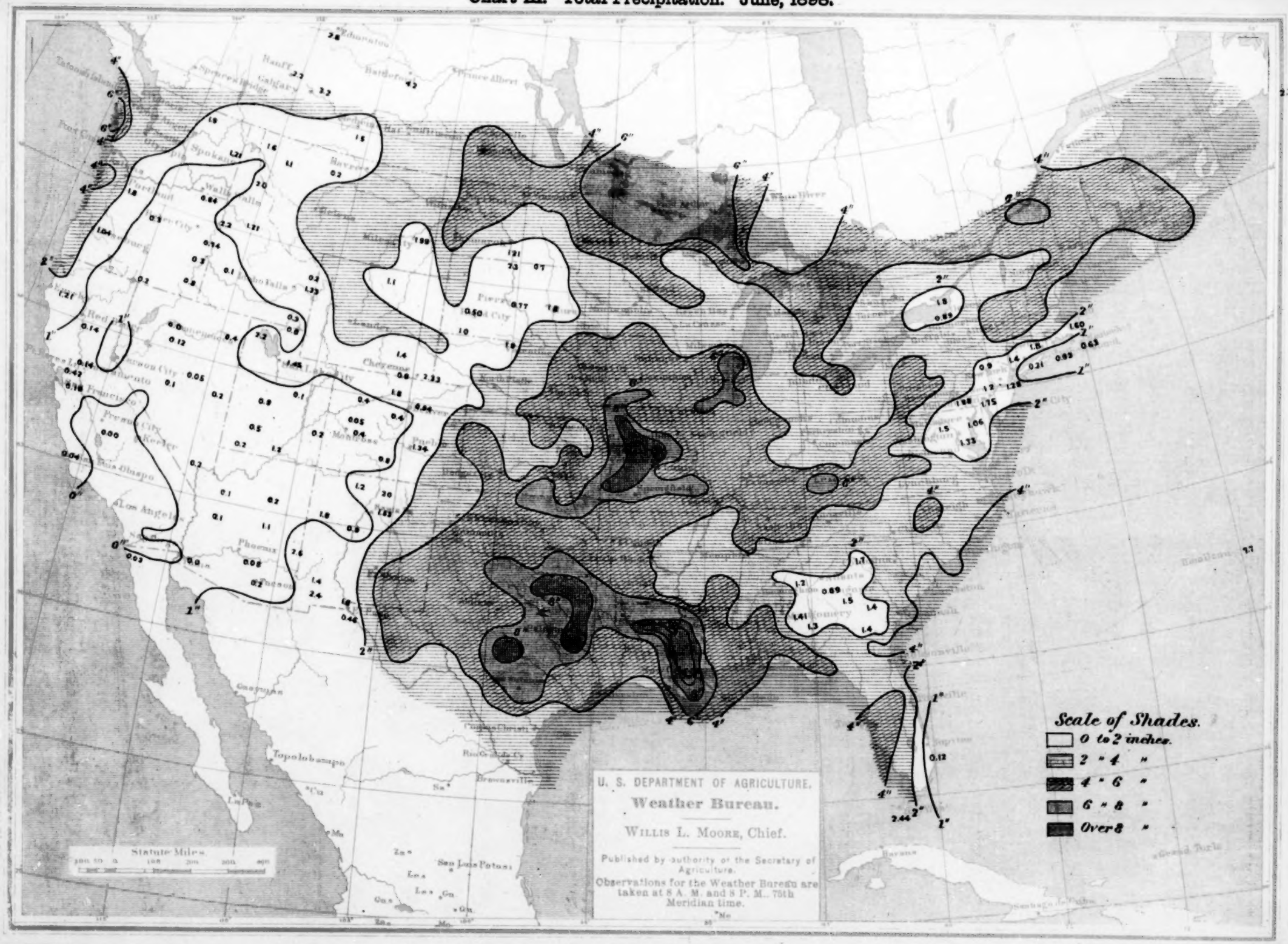


Chart III. Total Precipitation. June, 1898.

Chart III. Total Precipitation. June, 1898.


Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
Statute Miles
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Weather Bureau.
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Chart IV. Sea-Level Pressure and Temperature and Resultant Surface Winds. June, 1898.

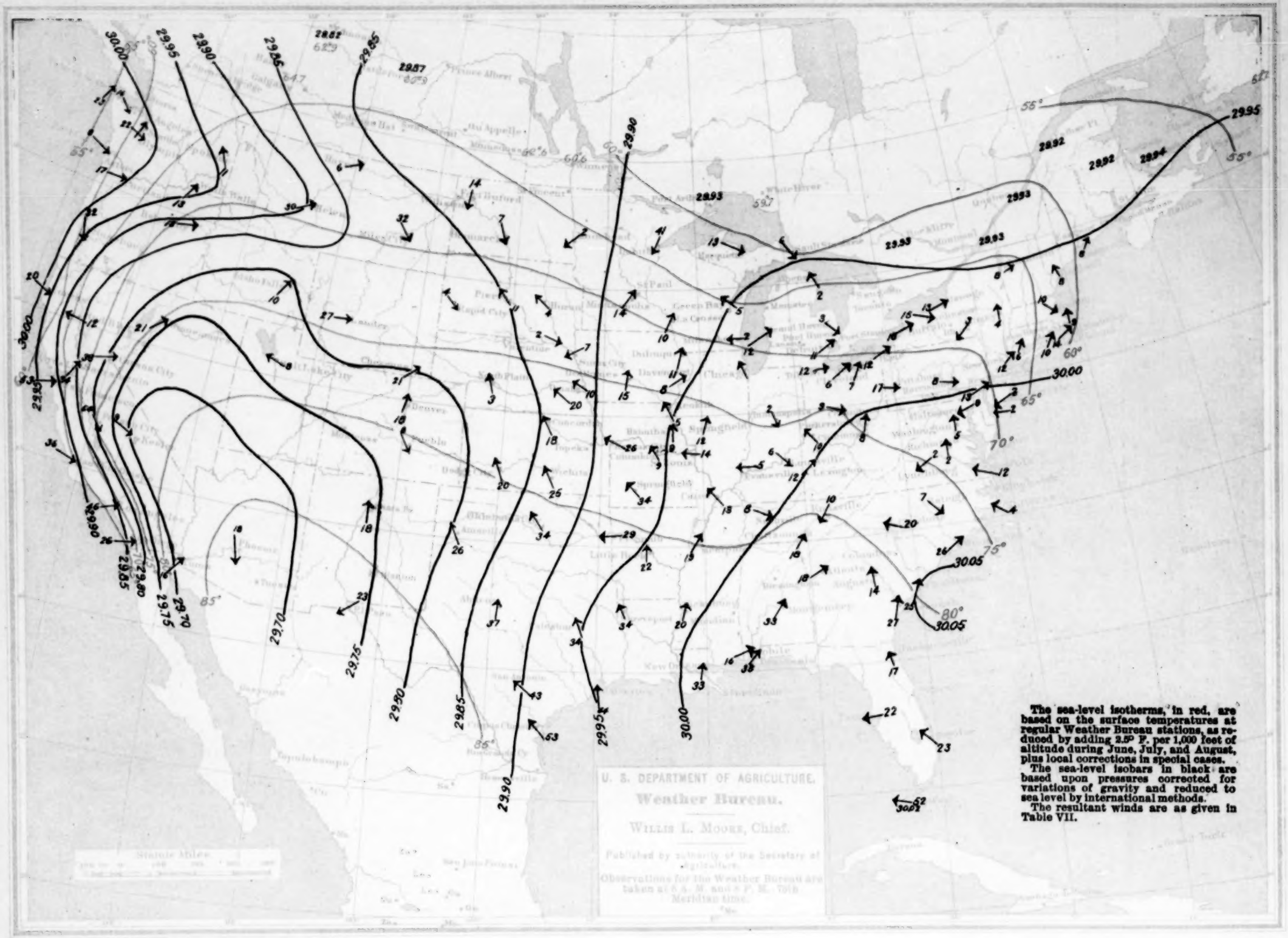
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Chart V. Hydrographs for Seven Principal Rivers of the United States. June, 1898.

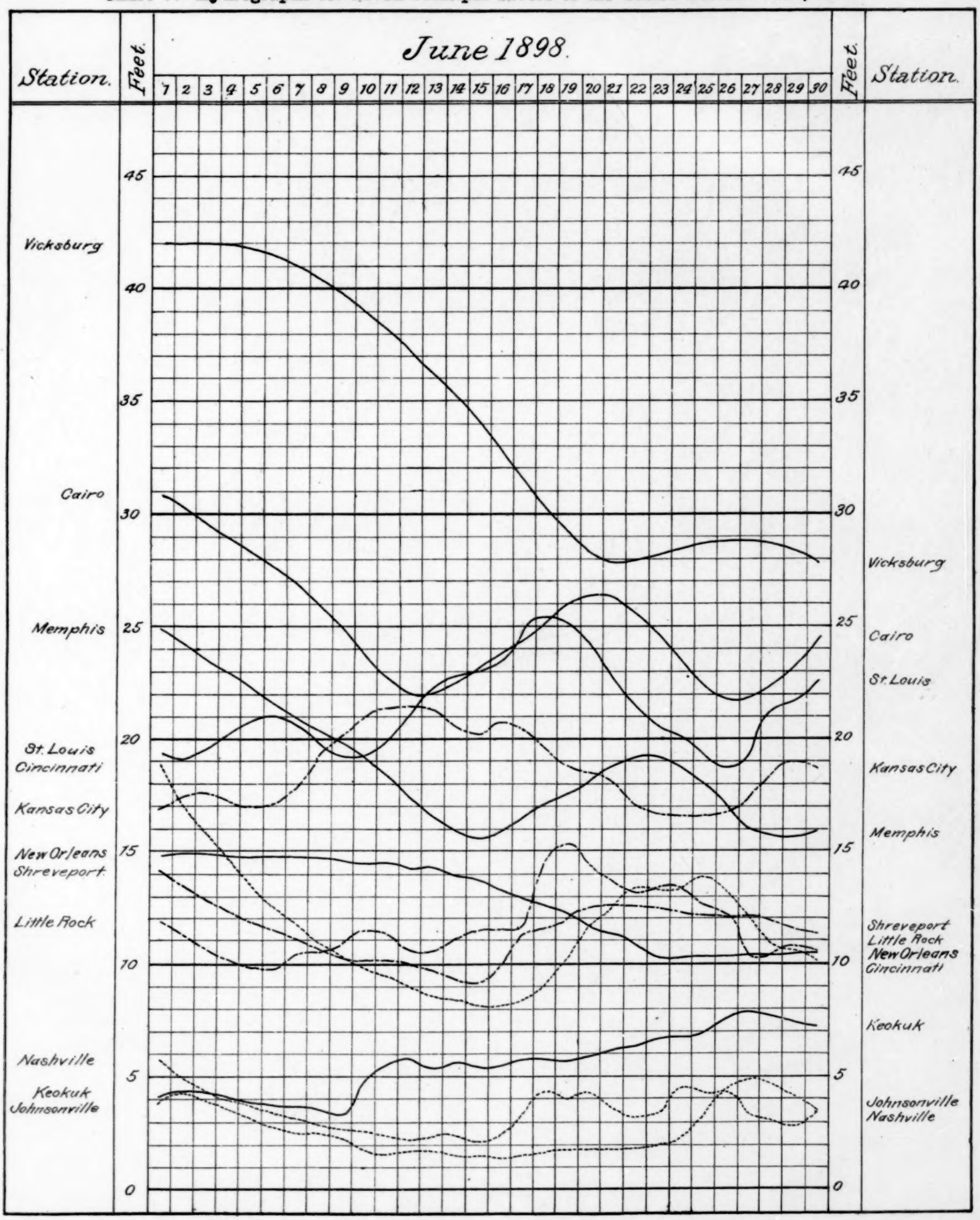
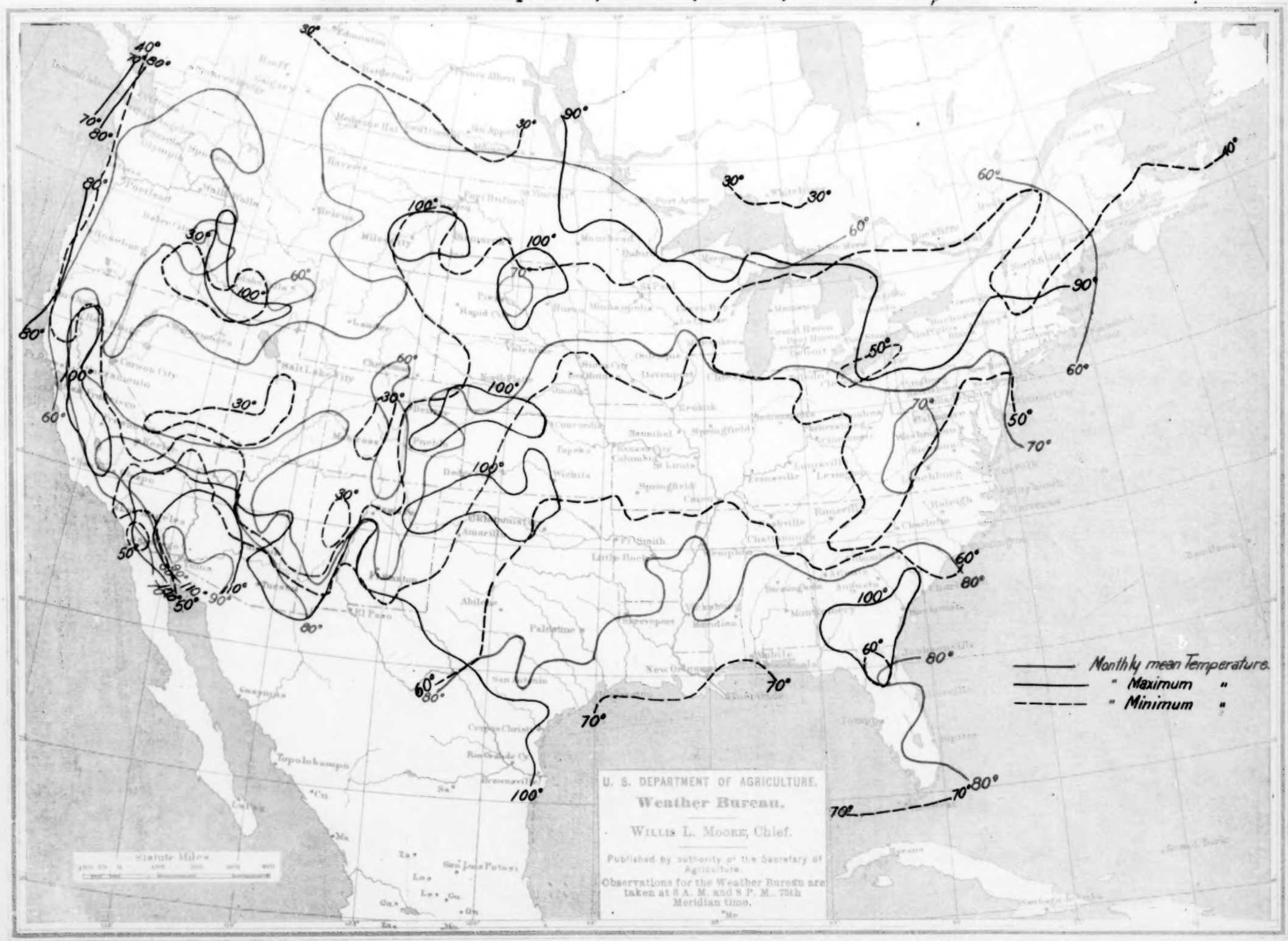


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. June, 1898.


Monthly mean Temperature.
" Maximum "
" Minimum "
Statute Miles
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Weather Bureau.
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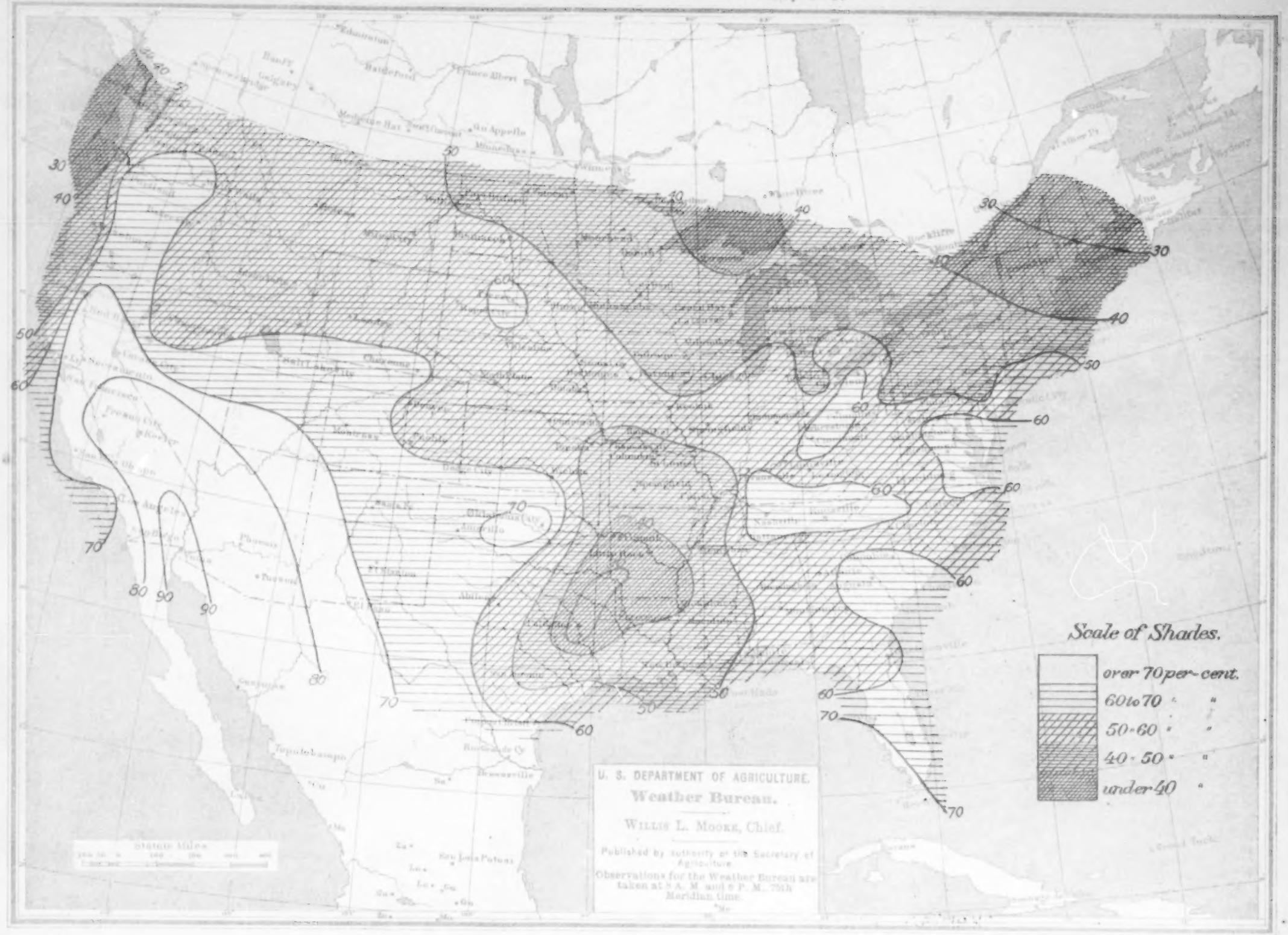
Chart VII. Percentage of Sunshine. June, 1898.


Scale of Shades.
over 70 per cent.
60 to 70 " "
50-60 " "
40-50 " "
under 40 "
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
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Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles